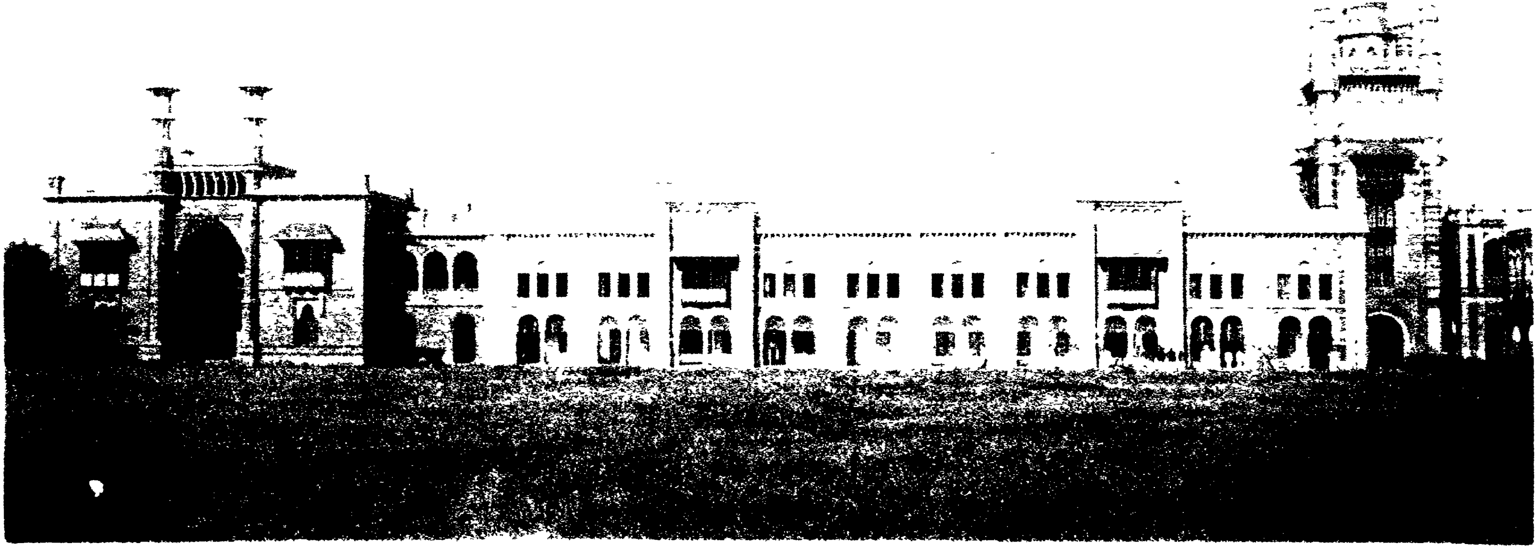

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College of Engineering,
MADRAS.

CALENDAR

FOR

1896.

MADRAS:
PRINTED BY THE SUPERINTENDENT, GOVERNMENT PRESS.

1896.

Madras College of Engineering—Calendar 1896.

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CALENDAR,

COLLEGE OF ENGINEERING.

JANUARY 1896.

Date.	Day of Week.	
1	W.	
2	Th.	
3	F.	
4	Sat.	
5	Sun.	
6	M.	
7	Tu.	
8	W.	
9	Th.	
10	F.	
11	Sat.	
12	Sun.	Pongal.
13	M.	
14	Tu.	
15	W.	
16	Th.	
17	F.	Christmas vacation ends.
18	Sat.	
19	Sun.	
20	M.	College re-opens after the Christmas vacation. Students join practical course. B.E. Degree and F.E. Examinations begin.
21	Tu.	
22	W.	
23	Th.	
24	F.	Names of Certificate-holders to be sent to Gazette.
25	Sat.	
26	Sun.	
27	M.	Selected candidates for Engineer, Draftsman, and Surveyor classes join.
28	Tu.	Selected candidates for Artisan class join.
29	W.	
30	Th.	
31	F.	

FEBRUARY 1896.

Date.	Day of Week.	
1	Sat.	
2	Sun.	
3	M.	Letter to the Director of Public Instruction, regarding places of Entrance Examination, and Superintendents, due.
4	Tu.	
5	W.	
6	Th.	
7	F.	
8	Sat.	
9	Sun.	
10	M.	
11	Tu.	*Maha Sivarathri.* College holiday.
12	W.	
13	Th.	
14	F.	Return of Establishment on 1st January due.
15	Sat.	
16	Sun.	
17	M.	Term fees (January to June) and Monthly fees (January and February) due.
18	Tu.	
19	W.	Ash Wednesday.
20	Th.	
21	F.	
22	Sat.	
23	Sun.	
24	M.	Indents for English Stores, Library and Class Books, due. Notification to Gazette, regarding admission to Engineer Subordinate class, due.
25	Tu.	
26	W.	
27	Th.	
28	F.	
29	Sat.	

MARCH 1896.

Date.	Day of Week.	
1	Sun.	
2	M.	
3	Tu.	
4	W.	
5	Th.	
6	F.	
7	Sat.	
8	Sun.	
9	M.	Indents for students' instruments due
10	Tu.	
11	W.	
12	Th.	
13	F.	
14	Sat.	
15	Sun.	*Telugu New Year's day.*
16	M.	Monthly fees due.
17	Tu.	*Id-i-Ramzan.* College holiday.
18	W.	
19	Th.	
20	F.	
21	Sat.	
22	Sun.	
23	M.	
24	Tu.	
25	W.	
26	Th.	
27	F.	
28	Sat.	
29	Sun.	
30	M.	Latest date for applications for registration for Engineer Subordinate class.
31	Tu.	

FEBRUARY 1896.

Date.	Day of Week.	
1	Sat.	
2	Sun.	
3	M.	Letter to the Director of Public Instruction, regarding places of Entrance Examination, and Superintendents, due.
4	Tu.	
5	W.	
6	Th.	
7	F.	
8	Sat.	
9	Sun.	
10	M.	
11	Tu.	*Maha Sivarathri.* College holiday.
12	W.	
13	Th.	
14	F.	Return of Establishment on 1st January due.
15	Sat.	
16	Sun.	
17	M.	Term fees (January to June) and Monthly fees (January and February) due.
18	Tu.	
19	W.	Ash Wednesday.
20	Th.	
21	F.	
22	Sat.	
23	Sun.	
24	M.	Indents for English Stores, Library and Class Books, due. Notification to Gazette, regarding admission to Engineer Subordinate class, due.
25	Tu.	
26	W.	
27	Th.	
28	F.	
29	Sat.	

MARCH 1896.

Date.	Day of Week.	
1	Sun.	
2	M.	
3	Tu.	
4	W.	
5	Th.	
6	F.	
7	Sat.	
8	Sun.	
9	M.	Indents for students' instruments due
10	Tu.	
11	W.	
12	Th.	
13	F.	
14	Sat.	
15	Sun.	*Telugu New Year's day.*
16	M.	Monthly fees due.
17	Tu.	*Id-i-Ramzan.* College holiday.
18	W.	
19	Th.	
20	F.	
21	Sat.	
22	Sun.	
23	M.	
24	Tu.	
25	W.	
26	Th.	
27	F.	
28	Sat.	
29	Sun.	
30	M.	Latest date for applications for registration for Engineer Subordinate class.
31	Tu.	

FEBRUARY 1896.

Date.	Day of Week.	
1	Sat.	
2	Sun.	
3	M.	Letter to the Director of Public Instruction, regarding places of Entrance Examination, and Superintendents, due.
4	Tu.	
5	W.	
6	Th.	
7	F.	
8	Sat.	
9	Sun.	
10	M.	
11	Tu.	*Maha Sivarathri.* College holiday.
12	W.	
13	Th.	
14	F.	Return of Establishment on 1st January due.
15	Sat.	
16	Sun.	
17	M.	Term fees (January to June) and Monthly fees (January and February) due.
18	Tu.	
19	W.	Ash Wednesday.
20	Th.	
21	F.	
22	Sat.	
23	Sun.	
24	M.	Indents for English Stores, Library and Class Books, due. Notification to Gazette, regarding admission to Engineer Subordinate class, due.
25	Tu.	
26	W.	
27	Th.	
28	F.	
29	Sat.	

MARCH 1896.

Date.	Day of Week.	
1	Sun.	
2	M.	
3	Tu.	
4	W.	
5	Th.	
6	F.	
7	Sat.	
8	Sun.	
9	M.	Indents for students' instruments due.
10	Tu.	
11	W.	
12	Th.	
13	F.	
14	Sat.	
15	Sun.	*Telugu New Year's day.*
16	M.	Monthly fees due.
17	Tu.	*Id-i-Ramzan.* College holiday.
18	W.	
19	Th.	
20	F.	
21	Sat.	
22	Sun.	
23	M.	
24	Tu.	
25	W.	
26	Th.	
27	F.	
28	Sat.	
29	Sun.	
30	M.	Latest date for applications for registration for Engineer Subordinate class.
31	Tu.	

APRIL 1896.

Date.	Day of Week.	
1	W.	
2	Th.	Easter Holidays begin.
3	F.	Good Friday.
4	Sat.	
5	Sun.	
6	M.	
7	Tu.	Easter Holidays end.
8	W.	
9	Th.	
10	F.	
11	Sat.	
12	Sun.	*Tamil New Year's day.*
13	M.	
14	Tu.	
15	W.	Half-yearly Return of Receipts and Charges, due. Monthly fees (April and May) due. Receipt for Permanent Advance due.
16	Th.	
17	F.	Annual Return No. 1 (*b*) due.
18	Sat.	
19	Sun.	
20	M.	
21	Tu.	
22	W.	
23	Th.	
24	F.	
25	Sat.	Military Probationers' Examination takes place.
26	Sun.	
27	M.	Entrance Examination, Engineer Subordinate class, takes place.
28	Tu.	List of officers of the Educational Department due.
29	W.	
30	Th.	

MAY 1896.

Date	Day of Week.	
1	F.	College Long Vacation begins. Interest due on endowments.
2	Sat.	
3	Sun.	
4	M.	
5	Tu.	
6	W.	
7	Th.	
8	F.	
9	Sat.	
10	Sun.	
11	M.	
12	Tu.	
13	W.	
14	Th.	
15	F.	Annual Return No. 6 (*b*) due.
16	Sat.	
17	Sun.	
18	M.	
19	Tu.	
20	W.	
21	Th.	
22	F.	
23	Sat.	
24	Sun.	Queen's Birthday.
25	M.	Return of Expenditure on Stores due.
26	Tu.	
27	W.	
28	Th.	
29	F.	
30	Sat.	
31	Sun.	

JUNE 1896.

Date.	Day of Week.	
1	M.	
2	Tu.	
3	W.	
4	Th.	
5	F.	
6	Sat.	
7	Sun.	
8	M.	
9	Tu.	
10	W.	
11	Th.	
12	F.	Annual Returns Nos. 7, 10, 11, 12, 16 and 17 due.
13	Sat.	
14	Sun.	
15	M.	
16	Tu.	
17	W.	
18	Th.	
19	F.	
20	Sat.	
21	Sun.	
22	M.	*Last day of Moharam.* College holiday.
23	Tu.	
24	W.	
25	Th.	
26	F.	
27	Sat.	
28	Sun.	
29	M.	
30	Tu.	

JULY 1896.

Date.	Day of Week.	
1	W.	College re-opens after the Long Vacation. Notification to Gazette regarding Entrance Examination, Accounts Branch, P.W.D., due. Histories of Services of Gazetted Officers due.
2	Th.	
3	F.	
4	Sat.	
5	Sun.	
6	M.	Successful candidates join the Engineer Subordinate class.
7	Tu.	
8	W.	
9	Th.	
10	F.	
11	Sat.	
12	Sun.	
13	M.	
14	Tu.	
15	W.	Term fees (July to December) and Monthly fees (June and July) due.
16	Th.	
17	F.	
18	Sat.	
19	Sun.	
20	M.	
21	Tu.	
22	W.	
23	Th.	
24	F.	
25	Sat.	
26	Sun.	
27	M.	
28	Tu.	
29	W.	
30	Th.	
31	F.	

JUNE 1896.

Date.	Day of Week.	
1	M.	
2	Tu.	
3	W.	
4	Th.	
5	F.	
6	Sat.	
7	Sun.	
8	M.	
9	Tu.	
10	W.	
11	Th.	
12	F.	Annual Returns Nos. 7, 10, 11, 12, 16 and 17 due.
13	Sat.	
14	Sun.	
15	M.	
16	Tu.	
17	W.	
18	Th.	
19	F.	
20	Sat.	
21	Sun.	
22	M.	*Last day of Moharam.* College holiday.
23	Tu.	
24	W.	
25	Th.	
26	F.	
27	Sat.	
28	Sun.	
29	M.	
30	Tu.	

JULY 1896.

Date.	Day of Week.	
1	W.	College re-opens after the Long Vacation. Notification to Gazette regarding Entrance Examination, Accounts Branch, P.W.D., due. Histories of Services of Gazetted Officers due.
2	Th.	
3	F.	
4	Sat.	
5	Sun.	
6	M.	Successful candidates join the Engineer Subordinate class.
7	Tu.	
8	W.	
9	Th.	
10	F.	
11	Sat.	
12	Sun.	
13	M.	
14	Tu.	
15	W.	Term fees (July to December) and Monthly fees (June and July) due.
16	Th.	
17	F.	
18	Sat.	
19	Sun.	
20	M.	
21	Tu.	
22	W.	
23	Th.	
24	F.	
25	Sat.	
26	Sun.	
27	M.	
28	Tu.	
29	W.	
30	Th.	
31	F.	

AUGUST 1896.

Date.	Day of Week.	
1	Sat.	
2	Sun.	
3	M.	Applications for the Entrance Examination, Accounts Branch, P.W.D., due.
4	Tu.	
5	W.	
6	Th.	
7	F.	Budget Estimate due. Return of Sale of Furniture due.
8	Sat.	
9	Sun.	
10	M.	
11	Tu.	
12	W.	
13	Th.	
14	F.	
15	Sat.	Monthly fees due.
16	Sun.	
17	M.	
18	Tu.	
19	W.	
20	Th.	
21	F.	*Avani Avittam* College holidays.
22	Sat.	
23	Sun.	
24	M.	Indents for Students' Instruments due.
25	Tu.	
26	W.	
27	Th.	
28	F.	
29	Sat.	
30	Sun.	
31	M.	*Gokula Ashtami. Sri Jainti.* College holiday.

SEPTEMBER 1896.

Date.	Day of Week.	
1	Tu.	Indent for Prizes due. Entrance Examination, Accounts Branch, P.W.D. Letter to the Director of Public Instruction, regarding places of Entrance Examination, and Superintendents, due.
2	W.	
3	Th.	
4	F.	
5	Sat.	
6	Sun.	
7	M.	
8	Tu.	
9	W	
10	Th.	*Chaturthi.* College holiday.
11	F.	
12	Sat.	
13	Sun.	
14	M.	
15	Tu.	Monthly fees due.
16	W.	
17	Th.	
18	F.	
19	Sat.	
20	Sun.	
21	M.	Notifications to Gazette regarding admission to Engineer, Draftsman, Surveyor and Artisan classes, and regarding Certificate Examinations for Independent Engineer, Engineer Subordinate, Draftsman and Surveyor candidates.
22	Tu.	
23	W.	
24	Th.	
25	F.	
26	Sat.	
27	Sun.	
28	M.	Applications for B.E. Degree and F.E. Examinations due.
29	Tu.	
30	W.	

OCTOBER 1896.

Date.	Day of Week.	
1	Th.	
2	F.	
3	Sat.	
4	Sun.	
5	M.	
6	Tu.	*Mahalaya Amavasya.* College holiday.
7	W.	
8	Th.	
9	F.	
10	Sat.	
11	Sun.	
12	M.	
13	Tu.	
14	W.	
15	Th.	*Dasara.* College holiday
16	F.	Monthly fees due.
17	Sat.	
18	Sun.	
19	M.	Applications for Entrance Examinations, Engineer, Draftsman and Surveyor classes due.
20	Tu.	
21	W.	
22	Th.	
23	F.	
24	Sat.	
25	Sun.	
26	M.	
27	Tu.	
28	W.	
29	Th.	
30	F.	
31	Sat.	

NOVEMBER 1896.

Date.	Day of Week.	
1	Sun.	
2	M.	Indent for General and Special stationery due. Interest due on endowments. Applications due for admission to Artisan class. Latest date for Applications for Certificate Examinations for Independent Engineer, Engineer Subordinate, Draftsman and Surveyor candidates.
3	Tu.	*Dipavali.* College holidays.
4	W.	
5	Th.	
6	F.	
7	Sat.	
8	Sun.	
9	M.	Application for transfer of students to practical course due.
10	Tu.	
11	W.	
12	Th.	
13	F.	
14	Sat.	
15	Sun.	
16	M.	Monthly fees due. Final Examination fees of College students due.
17	Tu.	
18	W.	Entrance Examination papers due.
19	Th.	
20	F.	
21	Sat.	
22	Sun.	
23	M.	Application for progress reports on practical courses due.
24	Tu.	
25	W.	
26	Th.	
27	F.	
28	Sat.	
29	Sun.	
30	M.	

OCTOBER 1896.

Date.	Day of Week.	
1	Th.	
2	F.	
3	Sat.	
4	Sun.	
5	M.	
6	Tu.	*Mahalaya Amavasya.* College holiday.
7	W.	
8	Th.	
9	F.	
10	Sat.	
11	Sun.	
12	M.	
13	Tu.	
14	W.	
15	Th.	*Dasara.* College holiday.
16	F.	Monthly fees due.
17	Sat.	
18	Sun.	
19	M.	Applications for Entrance Examinations, Engineer, Draftsman and Surveyor classes due.
20	Tu.	
21	W.	
22	Th.	
23	F.	
24	Sat.	
25	Sun.	
26	M.	
27	Tu.	
28	W.	
29	Th.	
30	F.	
31	Sat.	

NOVEMBER 1896.

Date.	Day of Week.	
1	Sun.	
2	M.	Indent for General and Special stationery due. Interest due on endowments. Applications due for admission to Artisan class. Latest date for Applications for Certificate Examinations for Independent Engineer, Engineer Subordinate, Draftsman and Surveyor candidates.
3	Tu.	*Dipavali*. College holidays.
4	W.	
5	Th.	
6	F.	
7	Sat.	
8	Sun.	
9	M.	Application for transfer of students to practical course due.
10	Tu.	
11	W.	
12	Th.	
13	F.	
14	Sat.	
15	Sun.	
16	M.	Monthly fees due. Final Examination fees of College students due.
17	Tu.	
18	W.	Entrance Examination papers due.
19	Th.	
20	F.	
21	Sat.	
22	Sun.	
23	M.	Application for progress reports on practical courses due.
24	Tu.	
25	W.	
26	Th.	
27	F.	
28	Sat.	
29	Sun.	
30	M.	

OCTOBER 1896.

Date.	Day of Week.	
1	Th.	
2	F.	
3	Sat.	
4	Sun.	
5	M.	
6	Tu.	*Mahalaya Amavasya.* College holiday.
7	W.	
8	Th.	
9	F.	
10	Sat.	
11	Sun.	
12	M.	
13	Tu.	
14	W.	
15	Th.	*Dasara.* College holiday
16	F.	Monthly fees due.
17	Sat.	
18	Sun.	
19	M.	Applications for Entrance Examinations, Engineer, Draftsman and Surveyor classes due.
20	Tu.	
21	W.	
22	Th.	
23	F.	
24	Sat.	
25	Sun.	
26	M.	
27	Tu.	
28	W.	
29	Th.	
30	F.	
31	Sat.	

NOVEMBER 1896.

Date.	Day of Week.	
1	Sun.	
2	M.	Indent for General and Special stationery due. Interest due on endowments. Applications due for admission to Artisan class. Latest date for Applications for Certificate Examinations for Independent Engineer, Engineer Subordinate, Draftsman and Surveyor candidates.
3	Tu.	*Dipavali.* College holidays.
4	W.	
5	Th.	
6	F.	
7	Sat.	
8	Sun.	
9	M.	Application for transfer of students to practical course due.
10	Tu.	
11	W.	
12	Th.	
13	F.	
14	Sat.	
15	Sun.	
16	M.	Monthly fees due. Final Examination fees of College students due.
17	Tu.	
18	W.	Entrance Examination papers due.
19	Th.	
20	F.	
21	Sat.	
22	Sun.	
23	M.	Application for progress reports on practical courses due.
24	Tu.	
25	W.	
26	Th.	
27	F.	
28	Sat.	
29	Sun.	
30	M.	

DECEMBER 1896.

Date.	Day of Week.	
1	Tu.	Final Examination begins—*Morn.* Differential and Integral Calculus, E i. *Aft.* Chemistry (paper), E i.
2	W.	*Morn.* Geology and Heat, E ii. *Aft.* Mechanics, E ii.
3	Th.	Applied Mechanics, E i, ES i.
4	F.	*Morn.* Mechanism and the Steam Engine, E i, ES i. *Aft.* Building and Bridge Construction, E ii, ES ii.
5	Sat.	*Morn.* Road and Railway Construction, E ii. Earthwork and Roads, ES ii *Aft.* Hydraulics and Irrigation Works, E i, ES i.
6	Sun.	
7	M.	Entrance Examination, Engineer Draftsman and Surveyor Classes. *Morn.* Geometry (Euclid) and Mensuration, E iii Euclid and Mensuration, ES ii. *Aft.* Chemistry (practical), E i. Trigonometry and Statics, ES i.
8	Tu.	*Morn.* Algebraic Geometry and Hydromechanics, E ii. *Aft* Arithmetic and Algebra, E iii, ES iii.
9	W.	*Morn.* Trigonometry and Geometry (Conics), E iii. *Aft.* Building Materials, E iii, ES iii
10	Th.	*Morn.* Language, E i, ES i
11	F.	*Morn.* Levelling, E ii, ES ii, S i. *Aft.* Drills and Exercises, E i, ES i, D i, S i.
12	Sat.	*Morn.* Topographical Drawing, E i, ES i, S i, D i. *Aft.* Theodolite Surveying, E i, ES i, S i
13	Sun.	
14	M.	*Morn.* Geometrical Drawing, E iii, ES iii, D ii. *Aft* Chain, Compass and Plane Table Surveying E iii, ES ii, S ii.
15	Tu.	*Vaikunta Ekadasi.* College holiday
16	W.	Monthly fees due. Building Drawing (Buildings), E ii, ES ii, D ii.
17	Th.	Machine Drawing, E i, ES i, D i.
18	F.	Building Drawing (Bridges and Irrigation Works), E i, ES i, D i.
19	Sat.	Estimating, E i, ES i, D i.
20	Sun.	
21	M.	Free-hand, Model and Perspective Drawing, E ii, ES ii, D i.
22	Tu.	
23	W.	Christmas vacation begins.
24	Th.	
25	F.	
26	Sat.	
27	Sun.	
28	M.	
29	Tu.	
30	W.	
31	Th.	

NOTE.—E i, E ii, and E iii signify 1st, 2nd and 3rd Divisions, respectively, of Engineer Class.
ES i, ES ii, and ES iii signify 1st, 2nd and 3rd Divisions, respectively, of Engineer Subordinate Class.
D i and D ii signify 1st and 2nd Divisions, respectively, of Draftsman Class.
S i and S ii, signify 1st and 2nd Divisions, respectively, of Surveyor Class.

JANUARY 1897.

Date.	Day of Week.	
1	F.	
2	Sat.	
3	Sun.	
4	M.	
5	Tu.	
6	W.	
7	Th.	
8	F.	
9	Sat.	
10	Sun.	
11	M.	*Pongal.*
12	Tu.	
13	W.	
14	Th.	
15	F.	
16	Sat.	
17	Sun.	Christmas vacation ends.
18	M.	College re-opens after the Christmas vacation. Students join practical course. B E. Degree and F.E. Examinations begin
19	Tu.	
20	W.	
21	Th.	
22	F.	Names of Certificate-holders to be sent to Gazette.
23	Sat.	
24	Sun.	
25	M.	Selected candidates for Engineer, Draftsman, and Surveyor classes join.
26	Tu.	Selected candidates for Artisan class join.
27	W.	
28	Th.	
29	F.	
30	Sat.	
31	Sun.	

DECEMBER 1896.

Date.	Day of Week.	
1	Tu.	Final Examination begins—*Morn.* Differential and Integral Calculus, E i. *Aft.* Chemistry (paper), E i.
2	W.	*Morn.* Geology and Heat, E ii. *Aft.* Mechanics, E ii.
3	Th.	Applied Mechanics, E i, ES i.
4	F.	*Morn.* Mechanism and the Steam Engine, E i, ES i. *Aft* Building and Bridge Construction, E ii, ES ii.
5	Sat.	*Morn.* Road and Railway Construction, E ii. Earthwork and Roads, ES ii. *Aft.* Hydraulics and Irrigation Works, E i, ES i.
6	Sun.	
7	M.	Entrance Examination, Engineer Draftsman and Surveyor Classes. *Morn.* Geometry (Euclid) and Mensuration, E iii. Euclid and Mensuration, ES ii. *Aft.* Chemistry (practical), E i Trigonometry and Statics, ES i.
8	Tu.	*Morn.* Algebraic Geometry and Hydromechanics, E ii. *Aft.* Arithmetic and Algebra, E iii, ES iii.
9	W.	*Morn.* Trigonometry and Geometry (Conics), E iii *Aft.* Building Materials, E iii, ES iii.
10	Th.	*Morn.* Language, E i, ES i
11	F.	*Morn* Levelling, E ii, ES ii, S i. *Aft* Drills and Exercises, E i, ES i, D i, S i
12	Sat.	*Morn.* Topographical Drawing, E i, ES i, S i, D i. *Aft.* Theodolite Surveying, E i, ES i, S i.
13	Sun.	
14	M.	*Morn.* Geometrical Drawing, E iii, ES iii, D ii. *Aft* Chain, Compass and Plane Table Surveying E iii, ES ii, S ii.
15	Tu.	*Vaikunta Ekadasi.* College holiday
16	W.	Monthly fees due. Building Drawing (Buildings), E ii, ES ii, D ii.
17	Th.	Machine Drawing, E i, ES i, D i
18	F.	Building Drawing (Bridges and Irrigation Works), E i, ES i, D i.
19	Sat.	Estimating, E i, ES i, D i
20	Sun.	
21	M.	Free-hand, Model and Perspective Drawing, E ii, ES ii, D i.
22	Tu.	
23	W.	Christmas vacation begins.
24	Th.	
25	F.	
26	Sat.	
27	Sun.	
28	M.	
29	Tu.	
30	W.	
31	Th.	

NOTE.—E i, E ii, and E iii signify 1st, 2nd and 3rd Divisions, respectively, of Engineer Class.
ES i, ES ii, and ES iii signify 1st, 2nd and 3rd Divisions, respectively, of Engineer Subordinate Class.
D i and D ii signify 1st and 2nd Divisions, respectively, of Draftsman Class.
S i and S ii, signify 1st and 2nd Divisions, respectively, of Surveyor Class.

JANUARY 1897.

Date.	Day of Week.	
1	F.	
2	Sat.	
3	Sun.	
4	M.	
5	Tu.	
6	W.	
7	Th.	
8	F.	
9	Sat.	
10	Sun.	
11	M.	*Pongal.*
12	Tu.	
13	W.	
14	Th.	
15	F.	
16	Sat.	
17	Sun.	Christmas vacation ends.
18	M.	College re-opens after the Christmas vacation. Students join practical course. B E. Degree and F.E. Examinations begin.
19	Tu.	
20	W.	
21	Th.	
22	F.	Names of Certificate-holders to be sent to Gazette.
23	Sat.	
24	Sun.	
25	M.	Selected candidates for Engineer, Draftsman, and Surveyor classes join.
26	Tu.	Selected candidates for Artisan class join.
27	W.	
28	Th.	
29	F.	
30	Sat.	
31	Sun.	

FEBRUARY 1897.

Date.	Day of Week.	
1	M.	Letter to the Director of Public Instruction, regarding places of Entrance Examination, and Superintendents, due.
2	Tu.	
3	W.	
4	Th.	
5	F.	
6	Sat.	
7	Sun.	
8	M.	
9	Tu.	
10	W.	
11	Th.	
12	F.	
13	Sat.	
14	Sun.	
15	M.	Return of Establishment on 1st January due. Term fees (January to June) and Monthly fees (January and February) due.
16	Tu.	
17	W.	
18	Th.	
19	F.	
20	Sat.	
21	Sun.	
22	M.	Indents for English Stores, Library and Class Books, due. Notification to Gazette, regarding admission to Engineer Subordinate class, due.
23	Tu.	
24	W.	
25	Th.	
26	F.	
27	Sat.	
28	Sun.	

MARCH 1897.

Date.	Day of Week.	
1	M.	
2	Tu.	
3	W.	
4	Th.	
5	F.	
6	Sat.	
7	Sun.	
8	M.	Indents for students' instruments due.
9	Tu.	
10	W.	
11	Th.	
12	F.	
13	Sat.	
14	Sun.	
15	M.	Monthly fees due.
16	Tu.	
17	W.	
18	Th.	
19	F.	
20	Sat.	
21	Sun.	
22	M.	
23	Tu.	
24	W.	
25	Th.	
26	F.	
27	Sat.	
28	Sun.	
29	M.	Latest date for applications for registration for Engineer Subordinate class.
30	Tu.	
31	W.	

College Staff.

Principal	Major H. D. Love, Royal Engineers, Fellow of the Madras University.
Professor of Engineering.	A. Chatterton, Esq., B.Sc., M.I.M.E., A.M. INST. C.E.
Professor of Mathematics.	E. W. Middlemast, Esq., M.A. *On other duty.* M.R.Ry. B. Hanumantha Rau, B.A., Acting.
Instructor in Engineering.	Sergeant B. O. Reynolds, sub. *pro tem.*
Instructor in Surveying and Drawing.	Sergeant W. H. Goddard.
Assistant Instructor in Surveying and Drawing.	Mr. J. Hamilton.
Assistant Instructor in Surveying.	M.R.Ry. R. A. Bhakya Mudaliar, sub. *pro tem.*
Assistant Instructor in Drawing.	Mr. W. C. H. Littlewood, sub. *pro tem.*
Second Assistant Instructor in Drawing.	M.R.Ry. S. Subrahmanya Aiyar, sub. *pro tem.*
Second Assistant Instructor in Surveying	M.R.Ry. R. A. Bhakya Mudaliyar. *On other duty.* M.R.Ry. M.A. Anantalwar, B.A., B.C.E., sub. *pro tem.*
Vernacular Assistants.	M.R.Ry. T. Bhavaniswami Rau, B.A., L.T. M.R.Ry. M. Parthasarathi Aiyangar, B.A., sub. *pro tem.*
Workshop Instructor ...	Mr. J. P. Perkins, sub. *pro tem.*
Instructor in Gymnastics.	M. Ghaus Khan.
Head Clerk and Accountant.	V. Balasundara Mudaliyar.
Librarian and Storekeeper.	S. Shiva Rau, sub. *pro tem.*
Superintendent of Military Students.	Sergeant W. H. Goddard.

History of the College.

THE College of Engineering is one of the oldest, if not the oldest of Madras Educational Institutions, springing, as it did, from a Survey School, which was founded a century ago. In 1793, twelve months after the establishment of the Observatory, Mr. Michael Topping, the Company's Astronomer, wrote to Sir Charles Oakeley, President and Governor in Council of Fort St. George, "I have been greatly retarded "for want of proper Draughtsmen to make copies of my late surveys "and plans of the Kistna, and, after much fruitless search, find but "one chance left me of obtaining a person duly qualified for the task." To meet this want of Draftsmen and to supply Surveyors, a Surveying School was established in the following year, 1794, with Mr. John Goldingham as its first Superintendent. Mr. Goldingham was also the Company's Astronomer, and, after 1797, combined with these offices the post of Inspector of Revenue Surveys. The establishment of boys or apprentices in the school, which occupied a building near the Observatory, was twelve. They were subsisted and clothed by the Superintendent, who drew 120 pagodas per mensem for that purpose, irrespective of the actual number of pupils under instruction. Mr. Goldingham reported on 14th April 1800 the names of the boys trained in the school from its foundation, and the nature of the work done by himself, with the view of remuneration being fixed for him. On 5th July the Government of Edward Lord Clive sanctioned the presentation to Mr. Goldingham of two thousand five hundred star pagodas. Subsequently the Superintendent's salary was fixed at 50 pagodas; and his staff consisted of an Usher and Assistant, Mr. W. Scott, on 25 pagodas, a Draftsman on 25 pagodas, a Munshi on 8 pagodas and four Lascars. The total cost of the school was 240 pagodas per mensem. The apprentices received instruction to enable them to become Surveyors, Draftsmen, Writers and Interpreters. They were employed under Collectors, on tank repairs, and in the Quartermaster-General's Department. At the end of 1804, Mr. Goldingham obtained leave, on medical certificate, to proceed to England "on the January ships" for three years, and Lieutenant James Warren, of the 33rd Regiment, an Assistant in the General Survey, was nominated to act in all his appointments. In 1810 the school was temporarily closed; but, on 10th September 1818, Major deHavilland, Inspector of Tank Estimates, pointed out to the Board of Revenue that the persons who had been educated at it were dying off, and he deemed it advisable that the school should be re-opened, on a more moderate scale, if necessary. He suggested that it should be attached to the office of the Inspector-General of Tank Estimates, that the teacher should be an experienced Surveyor, and that boys between twelve and fourteen years of age, selected from the Military Asylum or elsewhere, should be apprenticed for a term of seven or nine years. He recommended that the entrance examination should be in Reading, Writing, Arithmetic and Vernacular language, and that the apprentices should be drafted into the Tank Department as required, eventually becoming Assistant Surveyors. These proposals were sanctioned by Government

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On 17th July 1821, the Inspector-General pointed out that the transfer of the school to the Surveyor-General, which had been ordered two years before, was undesirable. He stated that the apprentices were trained as Surveyors, Levellers, Superintendents, Draftsmen, and Estimate-makers, and that geographical surveys were only occasionally required. He observed that, if the school were transferred, the students would acquire only a small part of the education necessary for the Revenue Department, while, in his own office, "they become familiar "with the works necessary to irrigation, and acquire a knowledge of "the elementary principles of hydraulics, and of the mode of carrying "the works into execution. They are moreover taught some of the "vernacular languages." The duties of the Revenue Department embraced the repair of tanks and water-courses, choultries, roads, and civil buildings. The Surveyor-General, however, urged the transfer of the school as well as the Observatory to his department, and the discussion went on until 1826, when the Board of Revenue, in reviewing the matter, observed that the duties in the two departments (Military and Revenue) were widely different, those of a Military Surveyor being limited to Surveying, Levelling and Drawing, while "a Revenue "Surveyor, on the contrary, has a variety of offices to fulfil, among "which surveying holds a very subordinate place. His time is chiefly "spent in inspecting tanks and other works of irrigation, drawing 'up estimates for their repair and improvement, superintending the 'erection of important and expensive works, such as sluices, anicuts, 'and calingulahs, regulating the prices of work in the different dis'tricts, and checking the expenditure, in short in performing exactly 'the same duties, though in a subordinate degree, which the Civil 'Engineers have to discharge. He acts as an assistant to the Civil 'Engineer, and his duties have the same analogy to those of the corre'sponding class of servants in the Surveyor-General's Department which "the office of the Civil Engineer bears to that of the Military Surveyor. "The denomination is the same, but the duties are essentially different." The Board added that the repair of tanks in the Madras Collectorate and in part of the Chingleput district was vested directly in the Inspector-General, who thus had opportunity of allowing his apprentices to acquire practical knowledge. The apprentices generally remained in Madras from one to three years. They were then attached to a Civil Engineer, for one or two years, and they were subsequently recalled to the Presidency, in order that their acquirements might be ascertained before they were finally sent out for responsible work. From these considerations, the Board stated that it would be a great mistake to place the Survey School under the Surveyor-General. The Government concurred in this view, and decided that the transfer ordered in 1819 should not take place. The school thus continued to be an integral part of the Civil Engineer's Department of the Board of Revenue.

From this time forward, and down to 1846, when European non-commissioned officers of the Sappers were first appointed Overseers, the Revenue Surveyors trained at the school were the only class of Upper Subordinates in this department, afterwards called the Public Works Department. They were so named because they were employed chiefly on productive irrigation works, and not on account of any connection with a Revenue Survey. Their duties consisted not only in surveying and levelling, but in projecting and inspecting small works, and in making estimates. The pupils, from five to seven in number, were admitted on passing an entrance examination in Arithemetic, Algebra, Geometry, and colloquial knowledge of a native language. The course of instruction occupied about a year and a half, and comprehended Algebra, Mensuration, Trigonometry, Building Construction, Surveying, Plan Drawing and Estimate-making. In 1842 it was recognized that the Survey School was quite inadequate to the wants of the department, and it was proposed to establish a "College of Engineers," in connection with the so-called "Madras University" (*i.e.*, the Presidency High School, afterwards Presidency College), in which Civil Engineering should be taught. The course was to comprise "Mathematics, Mechanics, Hydraulics, Surveying, Levelling, Drawing, Practical Mechanics, Practical Engineering in all its branches, Chemistry and Geology." The institution was designed to train officers of the line as Engineers, and civilians as Upper Subordinates. This proposal was negatived by the Honorable Court of Directors in 1843 on the ground that the condition of general education in the Presidency was not then sufficiently advanced to warrant the establishment of a College for scientific or professional objects. In 1847 the question of improving the efficiency of the Public Works Department having again been brought prominently forward, the Home Government concurred with the Government of India in representing to the Court the desirableness of establishing an Engineering Class in the University.

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The question was then referred to the Madras Public Works Commissioners, who recommended, in their first report, paragraphs 612 to 637, the establishment of a College at Madras on the model of that which had been founded in 1847 at Roorkee by the Lieutenant-Governor of the North-West Provinces. The College projected was to train men for the various subordinate grades of the Public Works Department, and was to consist of three branches, of which the first, for Sub-Engineers, was to be restricted to persons who had actually served as Overseers, the second was for Upper Subordinates, and the third for Lower Subordinates. The Principal was to be an officer selected from the Corps of Engineers. The students were all to receive stipends varying from Rs. 5 to Rs. 50 per mensem, and the cost of the scheme was estimated at from Rs. 50,000 to Rs. 60,000 per annum.

In 1854 the Governor-General, Lord Dalhousie, put forward the proposition that "whether by the extension of Major Maitland's school, or by its incorporation with a larger institution upon the 'principle of the Thomason College at Roorkee, a complete system of 'instruction shall be provided at Madras for every class belonging to 'the Department of Public Works, Europeans, East Indians or 'Natives, whether Artificers, Foreman Overseers, Surveyors or Civil 'Engineers." The Honorable Court expressed their concurrence in the proposition in their Despatch of 20th December 1854, adding to the Governor-General's words "we trust it will always be borne in "mind that practical knowledge of Mechanical Engineering is essential "to the perfect efficiency of a Civil Engineer." Early in 1855 the Director of Public Instruction, Mr. A. J. Arbuthnot, was called on to submit arrangements for the establishment of an Engineering School or College.

Mr. Arbuthnot, in his report, dated 20th July 1855, questioned the expediency of taking the school for Carnatic Ordnance Artificers as a basis for the proposed institution, on the grounds that a system of military discipline (the Ordnance Artificers being enlisted men) would be inapplicable, and that the duties of a Superintendent of the Gun Carriage Factory have no necessary connection with those of the Principal of an Engineering College. The Director then proceeded to recommend a modification of the scheme proposed by the Public Works Commissioners. He advocated the formation of three departments in the College, the establishment of scholarships in place of stipends to be open to public competition, as well as the provision of a boarding establishment for a certain number of the civil students, and of barracks for military students. He recommended that no fees should be exacted, that the courses of instruction should be those laid down by the Public Works Commissioners, that the staff should consist of an officer of Engineers with a staff salary of Rs. 700, a Professor of Engineering and Architecture on Rs. 600, two Mathematical Masters on Rs. 300 and Rs. 200, and a Surveying Master, a Drawing Master, and a Mechanist on Rs. 250 each. Provision was also made for workshops, brickfields, instruments, scholarships, &c., and the total estimated cost amounted to Rs. 58,200 per annum. No attempt was to be made to train the artificers required for the department, who were to be obtained from Major Maitland's school. The Madras Government approved these arrangements in August 1855, but considered that every student should be required to master some one trade or craft, and they advised that the school at the Gun Carriage Factory should be extended so as to supply the Public Works Department with artificers. The Chief Engineer, Lieutenant-Colonel Faber, pointed out, however, that a practical acquaintance with handicraft trades, however desirable it might be, would interfere with the studies required of a Civil Engineer or Subordinate, and that artificers in masonry, blasting, and carpentry should be trained rather on works than in a Gun Carriage Factory.

In the meantime the Government of India, on 12th January 1856, intimated, in a letter from Colonel Baker, their approval of Mr. Arbuthnot's scheme, but recorded their decided opinion that practical training should be given in the College, and suggested that the Gun Carriage school should be amalgamated with the new institution. The Government of Fort St. George was accordingly requested to submit revised proposals.

Major Maitland held the opinion that the orders of the Supreme Government were to be construed as conferring on him the sole direction of the projected College, and a voluminous correspondence ensued between himself, the Director of Public Instruction and the Chief Engineer, which was, in July 1856, submitted to the Government of India. The Supreme Government abandoned their original design of amalgamating Major Maitland's school with the intended College, but desired that Major Maitland should be connected with the College in the capacity of Director of Practical Instruction, and that his workshop should be made use of for the practical training of the students in the use of tools and machinery. Mr. Arbuthnot was accordingly directed to modify his original proposals. Pending the settlement of these questions the Madras Government, in September 1856, directed a committee of Public Works Officers to report on the best immediate means of providing instruction for the various grades in the department, and ordered that all candidates for the grade of Overseer, residing near Madras, should attend at the Survey School for instruction under Mr. O'Hara. The Committee, presided over by Colonel Faber, advised that the Survey School, which, in 1857, contained 46 students, should be enlarged, a Principal and staff at once appointed, and the premises which were then occupied by Messrs. Hider and Co. in Vepery acquired, their idea being that Subordinates only should be educated at Madras, while Engineers should receive training at Dowlaishweram under the Officer Commanding Sappers and Miners. These views were accepted by Mr. Arbuthnot, who, in April 1857, advised that a Principal be at once appointed to organize the institution with the Survey School as a basis, that a senior department should be constituted either at Madras or Dowlaishweram, and that schools be established in connection with the great workshops to supply artificers. These propositions were approved by the Government of Madras in the following June. Sanction was accorded at the same time to a scheme of tests for Assistant Engineers, Assistant Overseers and Sub-Overseers, First, Second and

Third class, which had been drawn up by Mr. D. F. Carmichael, Secretary to the Board of Examiners. The grades of Overseer, Supervisor, and Sub-Engineer were to be obtained by promotion only.

On 15th September 1857 Lieutenant G. Winscom, of the Madras Engineers, was appointed Principal of the projected institution, with a staff salary of Rs. 600 and house-rent Rs. 150, and that officer proceeded to take charge of the Survey School, and to draw up a scheme for the additional establishment required and for courses of instruction. The College was not to be divided into departments, but each student was to find his own level. All were to appear for the same examination, and four classes of certificate were to be issued, indicating fitness as (1) Engineers, (2) Sub-Engineers, (3) Supervisors and Overseers, (4) Sub-Overseers, respectively. The prospectus opened as follows:—" The " College is designed to prepare men for carrying out skilfully and " effectively the various kinds of engineering works needed in the " Madras Presidency, whether they be for Government or for private " companies and individuals. The instruction given will be adapted " to meet the requirements of all who may matriculate, as it will reach " to the standard laid down for the degree of Master of Civil Engi-" neering in the University of Madras. As, however, it is equally " intended to raise efficient Sub-Overseers, Overseers, Supervisors, &c., " the only preliminary knowledge which will be absolutely insisted " upon at entrance will be that of reading and writing with facility in " English or in a native language, and of simple arithmetic." In November Mr. Arbuthnot submitted proposals for an establishment consisting of a Principal (staff pay Rs. 800), two Mathematical Masters, a Professor of Geology and Chemistry, three Drawing and Surveying Masters, two Lecturers on Natural Philosophy and Mechanical Engineering, and three Munshis, at a total cost of Rs. 43,000, in which the military pay of the Principal was not included. The Director recommended that the " Ameer Bagh " buildings in the Mount Road should be acquired for the College. These proposals were approved by the Madras Government and forwarded to the Government of India.

In December 1857 Lieutenant Winscom proceeded to Calcutta to examine the system followed in the Civil Engineering College at Fort William, which had been opened just a year previously. The following remarks made to him by the Principal, Lieutenant Williams, are not inapplicable at the present day: " Text-books are evils, though " doubtless indispensable, especially when for the use of those who " evince so much readiness in getting up a subject by rote. Choice " of them is much hampered by the poverty of the students generally. " The evil effects of text-books may, it is hoped, be met by the Pro-" fessors generalizing, as much as possible in their lectures, and by a " set of books for consultation placed apart in the library, and open " at all times to the students." The result of Lieutenant Winscom's visit was that he advised that the Madras College students should be required to pay a fee of Rs. 2 per mensem, and that a Geological Museum and collection of specimens of timber should be formed. These proposals were approved.

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The school was accordingly limited at the outset to two departments to train candidates for the grades of Assistant Overseer and Sub-Overseer respectively. In July Captain Winscom and the Chief Engineer, Colonel Bell, urged the desirableness of forming a third department for the training of Draftsmen, Estimators and Accountants. The proposal was approved, but was not carried out until the following year. The employment of two Munshis was sanctioned, and the number of pupils was restricted to seventy. Twenty stipendiary

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In February 1863 Lieutenant-Colonel Carpendale was succeeded by Captain W. H. Edgcome, Royal (late Madras) Engineers. The new Principal lost no time in pointing out that the students should have practical as well as theoretical training, and urged that the mechanical class should be re-established as soon as the new central Public Works Workshops were erected at Chepâk. At this period the College consisted of—

(*a*) A First department training military officers and civilian Matriculates to become Assistant Engineers.

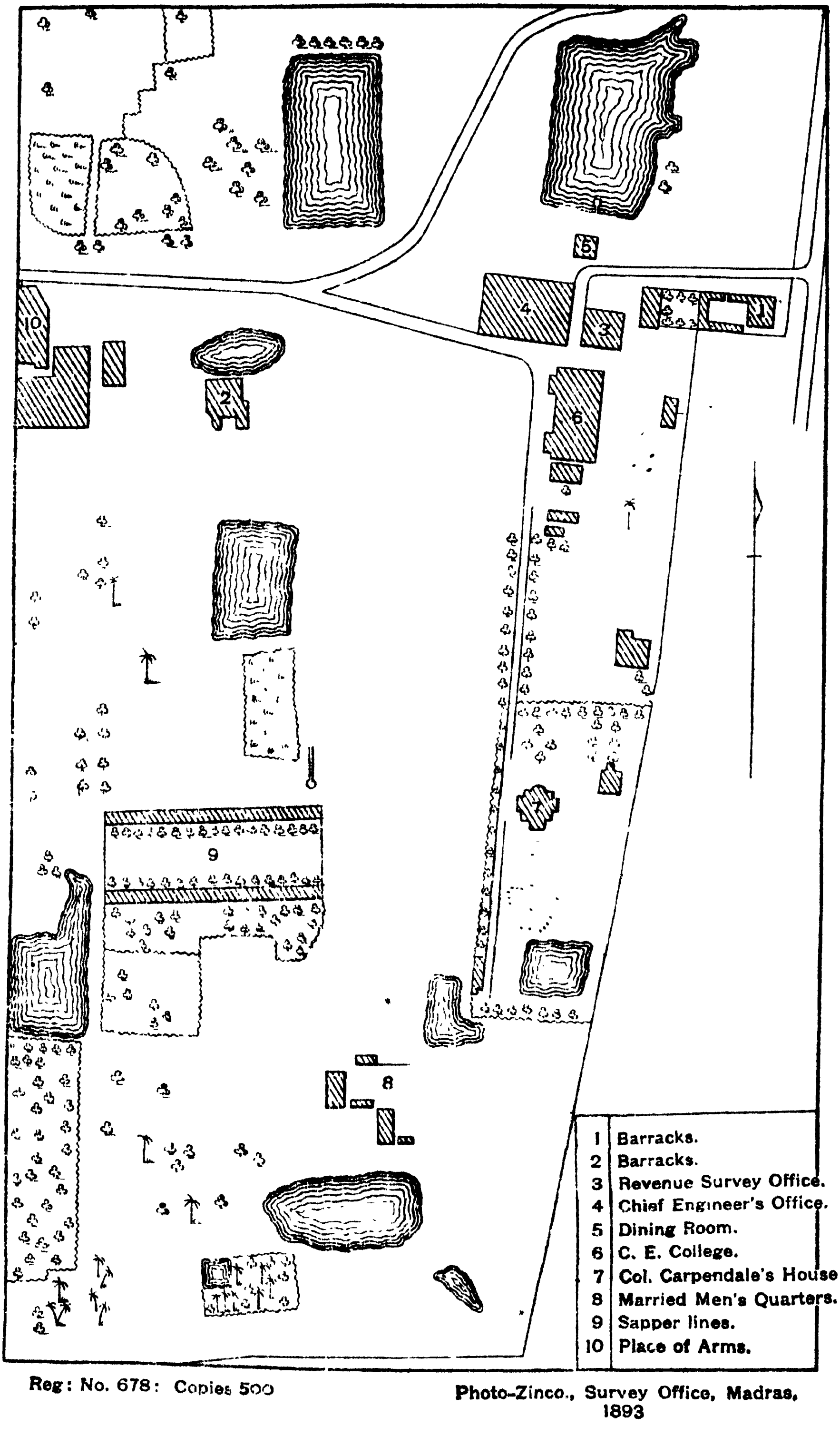
(*b*) A Second department educating non-commissioned officers and soldiers of the British Army, and civilians generally, for the Upper Subordinate branch of the Public Works Department.

(*c*) A Survey class for officers of the Army.

(*d*) A special Surveying, Drawing and Estimating class to train Surveyors and Draftsmen.

The number of students in the College ranged, at this time, from ninety to one hundred. Appointments as Overseer in the Public Works Department were made by District Engineers, who communicated their requirements to the Principal. During the year 1864 the designation of the certificate as "Assistant Overseer" was changed

CHEPAUK COMPOUND IN 1861



1	Barracks.
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3	Revenue Survey Office.
4	Chief Engineer's Office.
5	Dining Room.
6	C. E. College.
7	Col. Carpendale's House
8	Married Men's Quarters.
9	Sapper lines.
10	Place of Arms.

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Photo-Zinco., Survey Office, Madras,
1893

University. Sanction was accorded to the following staff:—First Assistant Master, Mr. Bradshaw, Rs. 400; Second Assistant, Mr. Gilby, Rs. 250; three junior Assistant Masters and two Munshis. There was also a Sergeant-Instructor in bricklaying, and a Sergeant-Major to regulate the discipline of the military students. The "First department" was formed in August 1862 with ten students, of whom five were military officers and the remainder civilians. The University Matriculation examination was the qualification for admission for the latter, while the military officers passed an entrance examination. A Survey class for military officers was established at the same time in order to enable young officers, candidates for the Revenue Survey or others, to qualify in surveying. Sanction was accorded by Government to its formation on the understanding that no cost would fall on the State. Each officer paid Rs. 16 per mensem, and the fees were used to remunerate the College masters for the extra work involved. The number of students was limited to ten and the course lasted six months. The class was in abeyance from 1864 to 1867, and was permanently discontinued after 1868. An additional certificate as "Assistant Overseer, Mysore," known after 1865 as "Assistant Overseer, Bengal," was awarded under the Bengal Code to students attaining a somewhat lower standard of proficiency than was required for "Assistant Overseer."

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In February 1863 Lieutenant-Colonel Carpendale was succeeded by Captain W. H. Edgcome, Royal (late Madras) Engineers. The new Principal lost no time in pointing out that the students should have practical as well as theoretical training, and urged that the mechanical class should be re-established as soon as the new central Public Works Workshops were erected at Chepâk. At this period the College consisted of—

(*a*) A First department training military officers and civilian Matriculates to become Assistant Engineers.

(*b*) A Second department educating non-commissioned officers and soldiers of the British Army, and civilians generally, for the Upper Subordinate branch of the Public Works Department.

(*c*) A Survey class for officers of the Army.

(*d*) A special Surveying, Drawing and Estimating class to train Surveyors and Draftsmen.

The number of students in the College ranged, at this time, from ninety to one hundred. Appointments as Overseer in the Public Works Department were made by District Engineers, who communicated their requirements to the Principal. During the year 1864 the designation of the certificate as "Assistant Overseer" was changed

CHEPAUK COMPOUND IN 1861

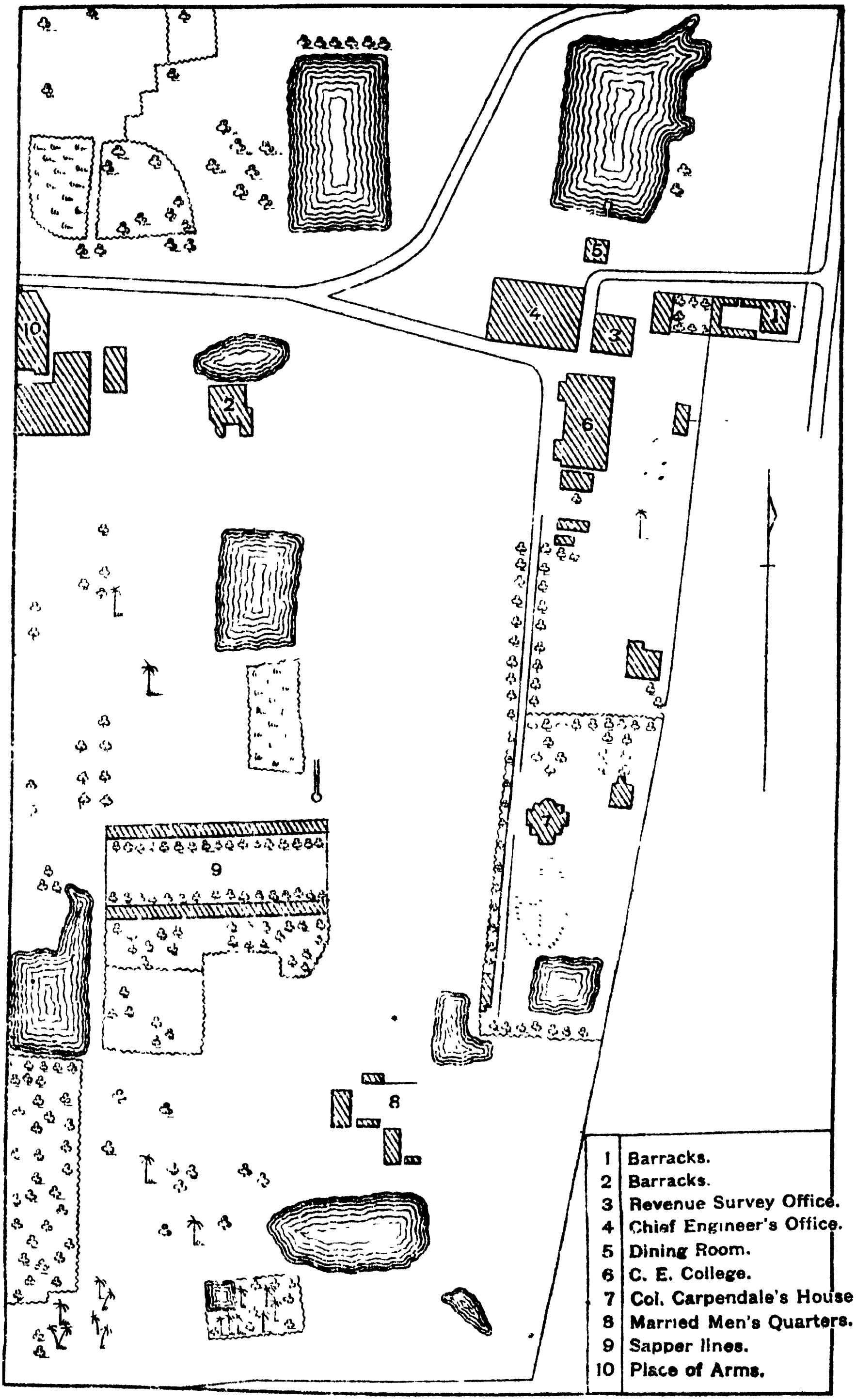

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Photo-Zinco., Survey Office, Madras,
1893

CHEPAUK COMPOUND IN 1893

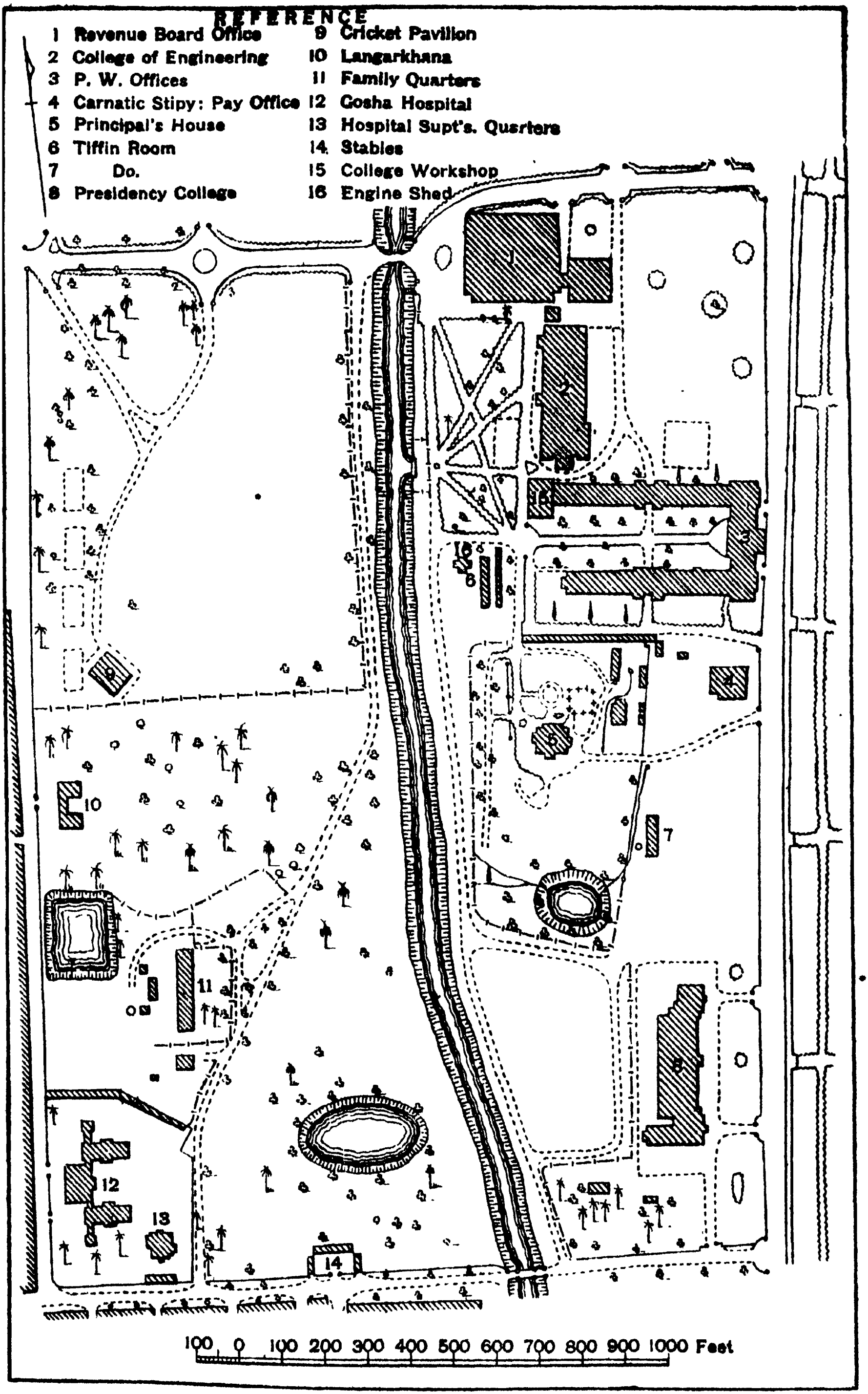

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Photo-Zinco., Survey Office, Madras
1893.

to "Taluk Overseer." In July Mr. Powell, the Director of Public Instruction, addressed a circular to Superintending Engineers to ascertain their views on the system of education adopted for subordinates. The replies indicated that a practical training was deemed desirable. Government thereupon ordered that the students during their second year of study "should be employed in connection with Public Works "at the Presidency." In the following November the Government decided that successful students of the First department should, as opportunity offered, be entertained as Second-class Supervisors. One of these, Mr. S. Subbaraya Chariyar, became in 1864 the first Bachelor of Civil Engineering at the Madras University. In October the Principal applied for the services of a Royal Engineer officer as Vice-Principal, his own time being so much occupied in teaching the First department that he was unable to supervise properly the work of the junior classes. The Government, however, decided that no additional expenditure could be incurred. A similar request was made in the following year with the same result. In February 1865 Captain Edgcome was temporarily employed on special service in Burma, and Captain H. T. Rogers, Royal (late Madras) Engineers, was appointed to act. Captain Edgcome resumed charge in the following September. Difficulty being experienced in securing the services of independent examiners, Captain Rogers advised the appointment of a paid Board. The Principal was responsible for all the examinations, but it was the practice to invite gentlemen unconnected with the College to examine the final year students of the First and Second departments for certificates. The certificate examinations for Draftsmen and Surveyors and for all independent candidates, as well as the College term examinations, were conducted by the staff. This practice continued down to 1885.

In 1865 the "Walker" Scholarship was founded by Lieutenant-Colonel Walker, Royal (late Madras) Engineers. Its value was Rs. 15 per mensem, and it was tenable by any native of the West Coast districts passing the entrance examination for the Second department, and qualifying in the Malayalam or Canarese language. The scholarship was first competed for in 1866.

In the course of that year the first class of the Second department spent some days at Pallávaram, as it had done on more than one previous occasion, in surveying hilly ground. Mr. Gilby, the Senior Instructor in Surveying, was granted a horse allowance of Rs. 25 to enable him to supervise the out-door survey work of the different classes efficiently. The course of instruction for the Surveying class was modified so as to meet the requirements of the Revenue Survey. Students of the Second department passing the Overseers' test were exempted from the Uncovenanted Civil Service General Test Examination. During August and September 1866 Captain Chrystie, Royal (late Madras) Engineers, acted for Captain Edgcome while the latter was on sick leave.

In June 1866 Mr. Powell, the Director of Public Instruction, strongly urged that passed students of the First department should be "tried in posts where the responsibility and remuneration are fairly commensurate with the education the young men have received." The Government stated that their services would be utilized when occasion offered, but that preference would be given to those who had entered in a subordinate grade, and who had thus acquired practical as well as theoretical knowledge. In the February following, the Principal pointed out that of the thirteen students who had down to that time, passed the highest College examination, only two had been appointed Assistant Engineers, viz., Lieutenant Taylor to Madras, and Mr. Hunter to Mysore. The remainder had either accepted subordinate posts or were unemployed. Captain Edgcome suggested that the grade of Apprentice Engineer be established in Madras as in Bengal, and recruited from the College. The Government, however, negatived the proposal, and it was not until several years later that the first native Assistant Engineer was appointed to the Public Works Department.

In April 1867 the pay of the First Assistant Master, Mr. Bradshaw, was raised to Rs. 500, that of the Second Assistant, Mr. Gilby, was augmented to Rs. 275 by the inclusion in it of his horse allowance of Rs. 25, and the salaries of the three junior masters were increased by sums varying from Rs. 20 to Rs. 30. The library allowance had for some years been fixed at Rs. 500 per annum, and the allotment for prize books at Rs. 200. A library catalogue was first printed in 1868. Considerable additions were made from time to time during Captain Edgcome's principalship to the stock of models. Sanction was accorded in June 1867 to the erection of six married quarters, at a cost of Rs. 17,000, to replace the dilapidated barracks which had hitherto been occupied by military students with families. The quarters were constructed in the south-west angle of Chepâk Park, and were completed in January 1869.

In November 1868 it was ordered that the First Arts, instead of the Matriculation examination, should be the standard for admission to the First department, and that the session for that department should commence in January instead of August.

Consequent on the receipt from the Public Works Department of unfavorable reports regarding some of its Surveyors, the Government considered, in 1870, that a deficiency was indicated in the method of imparting instruction in Field work. The Principal explained that the teaching power was insufficient, and advised the appointment of a junior officer of Royal Engineers as Professor of Surveying, and of an additional master for the Special department. The latter recommendation was adopted, and the Drawing and Surveying classes obtained the services of separate instructors. The question of nominating a Vice-Principal was deferred until the pending reorganization of the Public Works Department should have been finally settled. At this period the average number of students ranged from seventy-five to ninety. The number in the First department fell to three owing to difficulty in obtaining suitable employment. All charges on account of the College were included in the Public Works budget.

In April 1871 Captain Edgcome proceeded to England on two years' sick leave, and Captain Rogers was again appointed to act. In the course of the year Mr. Gilby, the Second Assistant Master, left, and was succeeded by Sub-Conductor Schoury. The salaries of the Second, Third and Fourth Assistant Masters were redistributed, that of the Second Assistant being reduced to Rs. 210, and those of the third and fourth increased to Rs. 170 and Rs. 140, respectively. The military transferred to an "Unattached List" instead of to the "Effective Supernumeraries."

At this time two scholarships were founded in connection with the Faculties of Medicine and Engineering in the Madras University by the Maharajas of Travancore and Cochin, respectively. The scholarships are of value about Rs. 40 and Rs. 30, respectively, and are tenable for such periods as will permit the holders to qualify for the degree of M.B. and C.M. or of B.C.E.

At the prize distribution held at the College in May 1871 the Director of Public Instruction, Mr. Powell, in his opening address, urged on Lord Napier, who presided, the desirableness of holding out some definite encouragement to the students of the First department, by offering one or two Assistant Engineerships annually for competition. His Excellency made enquiries regarding the practice at Calcutta and Bombay, and directed the assembly of a Committee consisting of the Chief Engineer (Colonel Carpendale), the Director, and the Acting Principal to report on this matter, as well as on a proposal to redistribute the funds drawn by the stipendiary students. After consideration of the Committee's report, the Government, in May 1872, considered that "an appointment to the grade of Proba-" tionary Assistant Engineer may be made of Natives and East Indians "who have duly qualified at the Civil Engineering College and Uni-" versity." They also decided that the Bengal Overseer's standard should cease to be used in the College. These orders were followed by the appointment of Mr. S. Subbaraya Chariyar, B.C.E., to an Assistant Engineership, and by a substantial increase in the number of students entering the First department.

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The military students having been found unable to compete on equal terms with civilians in the subject of Vernacular language, it was arranged that the former should, after passing the Entrance examination, be attached to a regiment at Bangalore to study language. A Tamil and Telugu Munshi was accordingly appointed on Rs. 60, debitable to the Public Works Department, the charge being met by discontinuing the annual lectures on Chemistry and Geology. Mr. Powell, however, remarked that if the College was to turn out really good Engineers from the First department, some provision would have to be made for teaching the elements of Chemistry and Geology. In 1872 the appointment of Sergeant-Major on Rs. 80 was abolished, and the care of the military students was vested in the senior Warrant officer among the Assistant Masters.

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Major Elgcome having been appointed Professor of Surveying at Cooper's Hill College, Major Rogers was, on 9th May 1873, confirmed as Principal. Sub-Conductor Schoury, the Second Assistant Master, reverted to the Public Works Department after eight years' service in the College, his place being filled by Sub-Conductor Milne. Mr. Schoury is remembered by his works, a text-book on Estimating, which is still in use, and an atlas of Engineering drawings.

In April 1873 the Government of India ordered that the charges of the Civil Engineering College, being of a provincial nature, should be omitted from the Public Works budget, where they had found place since 1869, and that the provincial grant should be permanently increased by £4,200 to make up the deficit. The Madras Government accordingly decided that, as the College was "a purely educational "establishment under the orders of the Director of Public Instruction, "the appointment of Principal being extra-departmental," the cost should properly be debited to the head "Educational." A further addition of £104 per annum was subsequently made on account of instruments.

The College numbers which had been 117 in 1873 rose in the following year to 148. The large number, ten, in the First department, was attributed to the guarantee by Lord Napier's Government of an appointment which, it was understood, would take effect annually. Early in 1874 Mr. N. Ratnasabhapathi Pillai, B.A., B.C.E., who had passed first in the College examination of the previous December, was gazetted a Probationary Assistant Engineer. A scale of examination fees was sanctioned for independent candidates, the proceeds being assigned to the examining masters. Sub-Conductor Milne, the senior military Instructor, reverted to the Public Works Department, and was succeeded as Second Assistant Master by Sub-Conductor McAleese. Another Assistant Master, Sub-Conductor Cames, prepared and published a work on Building Materials and Construction, which was subsequently expanded into Civil Engineering College Papers No. X, *The Elements of Civil Engineering*, and used as a text-book in the College. The preparation of a second edition was sanctioned in 1877.

In January 1875 a proposal was approved to employ the allowance of Rs. 50 to the Superintendent of Military Students in raising the salaries of the Second and Third Assistant Masters to Rs. 215 each. On Major Rogers' promotion to the rank of Lieutenant-Colonel, the Government called for a report on the propriety of consolidating the Principal's salary, as well as on the question of restricting the College, in view of the establishment of the institution at Cooper's Hill, to the wants of the lower grades of the executive. Mr. Powell considered that "it would be a retrograde and impolitic measure to abolish the "Senior Department of the Civil Engineering College, as such a move "would practically debar the natives of this Presidency, and the "Europeans and Eurasians permanently settled in it, from admission "to the higher ranks of the Public Works Department." The Government thereupon decided that no change should be made in the constitution of the College, and that Colonel Rogers should retain the post of Principal.

In May 1876 Colonel Macdonald, the Director of Public Instruction, pointed out that the guarantee given by Lord Napier's Government to the College, which, it was understood, would take effect annually, had not been fulfilled. The Government thereupon decided that the guarantee was subject to the existence of vacancies in the Public Works Department. The next appointment from the College to the Engineering establishment was not conferred until 1880.

In July 1877 Lieutenant H. D. Love, R.E., was transferred temporarily from the Military Department to officiate for Mr. Bradshaw, appointed an Acting Inspector of Schools. The arrangement continued until the following December. In the coarse of the year the College was affiliated to the Madras University.

The ten Sapper scholarships sanctioned in 1872 not having been utilized since their establishment, and the system of open scholarships for civilians, tenable from the date of joining the Second department, not having been found to work satisfactorily, a re-arrangement of these bursaries was sanctioned in October 1877. The civil scholarships were converted into five of Rs. 15 each, tenable during the second year of study, and awarded on the result of the first year's examination. The Sapper stipends were made available for the Special Surveying and Drawing Classes, five in each, tenable during the second year's course.

Down to this time the passed students, especially those of the Second department, had experienced little difficulty in finding employment in the Public Works Department. While General Walker was Chief Engineer, many pupils of the First department received nominations as Overseers, and were rapidly advanced to the grade of Supervisor. The appointments of Second department men as Overseers rested with the District Engineers, and were formerly made by those officers in communication with the Principal. Latterly, however, passed students had sent in their applications direct to the District Engineers, a system which failed to ensure priority of employment to the best men of a batch. In 1879 a reorganization of the Public Works Department was effected, involving extensive reductions; and the total numbers in the College, which, during the two previous years, had stood at about 170, fell rapidly. A feature of the reorganization was that the College nominations as Overseer were henceforward made by the Chief Engineer instead of by District Officers, and it was stated that six appointments might be anticipated annually. The average number in preceding years had been fourteen.

Towards the close of 1879 Colonel Rogers was appointed Superintendent of the Revenue Survey, but he continued to fulfil his College duties in addition until January 1880, when Lieutenant H. D. Love, R.E., who had previously acted as Principal during Colonel Rogers' absence on privilege leave in 1879, was appointed. Colonel Rogers published two books during his tour of office, a work entitled the "Theory of Strains," for which he received the thanks of Government, and a manual of "First Lessons in Telugu."

It will be well, at this stage, to review the constitution of the different classes. The First department had lost its military element, and consisted of civilian under-graduates, principally natives, who were admitted between the ages of sixteen and twenty-two on production of the Unversity First Arts certificate, and satisfactory testimony to conduct and physical fitness. The course lasted two years, and was adapted to meet the Public Works standard for Assistant Engineers and the requirements of the University Degree in Engineering. It embraced

(1) *Mathematics.*—Algebra, Euclid, Mensuration, Plane Trigonometry, Statics, Dynamics and Hydrostatics; (2) *Engineering.*—Building Materials and Construction, Earthwork, Roads, Hydraulics, Bridges and Irrigation Works, and Applied Mechanics; (3) *Surveying.*—Chain and Compass Surveying, Levelling, and Traversing with the Theodolite; (4) *Drawing.*—Drawing Buildings, Bridges and Irrigation Works from copies and specifications and taking out estimates of quantities. The fee paid was Rs. 16 per mensem, and no scholarships or prizes were provided. The hours of work were 10 A.M. to 1 P.M. and 2 P.M. to 5 P.M. daily, except Wednesday, with field work one morning, from 6 A.M. to 8 A.M., in the week. Half-yearly examinations were held by the College staff which, with the plans executed during the course, carried about one-sixth of the total marks. The final examination was conducted in December, mainly by unpaid independent examiners, who served at the request of the Principal, and the distribution of marks was as follows :—Mathematics 800, Engineering 500, Surveying 550, Drawing 550, Session work 500 ; total 2,900. The qualifying marks for a certificate as Assistant Engineer were 33 per cent. on each of the above five subject heads, and 50 per cent. on the total. Students who failed were usually granted certificates as Overseer. Independent candidates were allowed to present themselves at the final examination on payment of a fee of Rs. 25. They scored no marks for Session work, and qualified on the reduced total. Instruction in Engineering was given by the Principal; that in the other branches by the Assistant Masters. The passed students secured employment in the Upper Subordinate, rarely in the Engineer ranks of the Public Works Department, and in the Engineering establishments of Native States and Local Boards.

The Second department consisted of non-commissioned officers and men of British regiments, and of European, Eurasian and Native civilians. The soldiers drew stipends of Rs. 10 each while at the College, and the number admitted was limited to five per annum. They received their rations, clothing and pay from the Military Department, were provided with barracks at the College, and were commanded by the Principal. Admission took place by Entrance examination, and the successful competitors proceeded for a year to Bangalore, where they were attached to a regiment to study language. After passing a satisfactory examination in this subject they were finally admitted to the College. Civilian candidates who were Matriculates were admitted without examination, but all others were tested in Arithmetic and English. The limits of age for civilians were 16 and 22. The course of study, which extended over two years, inclusive of vacations, comprised the subjects already enumerated for the First department, except Dynamics, Hydrostatics and Applied Mechanics, but carried to a lower standard, and in addition Language, viz., Tamil or Telugu. The hours of work were the same as for the First department. The half-yearly examinations and the plans carried one-fifth of the total marks. The final examinations were conducted in May by agency similar to that for the First department, and the marks were distributed as follows :—Mathematics 500, Engineering 400, Surveying 550, Drawing and Estimating 450, Language 100, Session work 500 ; total 2,500. The qualifying marks for a certificate as Supervisor were 35 per cent. of each of these six subject heads, and 60 per cent. of the total marks;

those for a certificate as Overseer 25 per cent. and 40 per cent., respectively. Students who failed were granted certificates as Draftsmen or Surveyors, if they displayed proficiency in the corresponding subjects. Independent candidates were permitted to present themselves for examination for certificates on payment of a fee of Rs. 15. The civilian students paid a fee of Rs. 3 monthly, and competed for five scholarships of Rs. 15 each, tenable during the second year of study. The Walker Scholarship, of Rs. 15, tenable for two years, was also available in this department. Scholarship-holders and military students paid no fees, and the latter were provided with books and instruments at the public expense. The passed men, including nearly all the military students, found employment mainly in the Upper Subordinate grades of the Public Works Department, from which a few of the Europeans were ultimately promoted to the superior establishment.

The Special department, which was divided into a Drawing class and a Surveying class, consisted entirely of civilians, who were admitted on the results of an Entrance examination in English and Arithmetic. The limits of age were 16 and 22, and the fee paid was Rs. 3 per mensem. The course in each class lasted two years. The marks at the half-yearly and final examinations were awarded by the College staff, and were distributed as follows:—*Drawing Class.*—Drawing from specification 100, Estimating 100, Copying 100, Session work 200; total 500. *Surveying Class.*—Chain, Compass, and Sextant Surveying 100, Levelling 100, Traversing with the Theodolite 100, Copying plans 100, Session work 300; total 700. Certificates as Draftsman or Surveyor were issued in three classes, the qualifying minima marks being *First class* 66 per cent. on each subject and 75 per cent. on the total, *Second class* 50 per cent. and 66 per cent., and *Third class* 33 per cent. and 50 per cent., respectively. Independent candidates were allowed to appear for the examination on payment of a fee of Rs. 7-8-0, and the certificate examinations were held by the College at out-stations as well as at Madras. Ten scholarships of Rs. 8 were tenable during the second year of study, five in each class. The working hours were from 10 A.M. to 3 P.M. for the Drawing class, and 11 A.M. to 3 P.M. with two mornings a week field work for the Surveying class. The passed men obtained employment mainly in the Public Works Deparment.

The First department was known as the "College," the Second and Special departments formed the "School." The course lasted two years for each of the four standards of training, viz., for Assistant Engineers, Overseers, Draftsmen and Surveyors. Candidates were admitted annually, so that the number of separate classes or "divisions" under instruction was eight. Each division of the First and Second departments devoted one morning a week to surveying field work, and each division of the Surveyors' class two mornings. A public prize distribution was held at the end of May, when the certificates were awarded to the Second and Special department pupils. The prizes consisted of books, and were all given to the Overseers' class. The Assistant Engineers passed out in December.

The year 1880 heralds the approach of an important crisis in the history of the College, as it saw the first step taken towards a complete reorganization of the institution, involving a development as wide as any that had been looked forward to by the earliest projectors. In

(1) *Mathematics.*—Algebra, Euclid, Mensuration, Plane Trigonometry, Statics, Dynamics and Hydrostatics; (2) *Engineering.*—Building Materials and Construction, Earthwork, Roads, Hydraulics, Bridges and Irrigation Works, and Applied Mechanics; (3) *Surveying.*—Chain and Compass Surveying, Levelling, and Traversing with the Theodolite; (4) *Drawing.*—Drawing Buildings, Bridges and Irrigation Works from copies and specifications and taking out estimates of quantities. The fee paid was Rs. 16 per mensem, and no scholarships or prizes were provided. The hours of work were 10 A.M. to 1 P.M. and 2 P.M. to 5 P.M. daily, except Wednesday, with field work one morning, from 6 A.M. to 8 A.M., in the week. Half-yearly examinations were held by the College staff which, with the plans executed during the course, carried about one-sixth of the total marks. The final examination was conducted in December, mainly by unpaid independent examiners, who served at the request of the Principal, and the distribution of marks was as follows :—Mathematics 800, Engineering 500, Surveying 550, Drawing 550, Session work 500 ; total 2,900. The qualifying marks for a certificate as Assistant Engineer were 33 per cent. on each of the above five subject heads, and 50 per cent. on the total. Students who failed were usually granted certificates as Overseer. Independent candidates were allowed to present themselves at the final examination on payment of a fee of Rs. 25. They scored no marks for Session work, and qualified on the reduced total. Instruction in Engineering was given by the Principal; that in the other branches by the Assistant Masters. The passed students secured employment in the Upper Subordinate, rarely in the Engineer ranks of the Public Works Department, and in the Engineering establishments of Native States and Local Boards.

The Second department consisted of non-commissioned officers and men of British regiments, and of European, Eurasian and Native civilians. The soldiers drew stipends of Rs. 10 each while at the College, and the number admitted was limited to five per annum. They received their rations, clothing and pay from the Military Department, were provided with barracks at the College, and were commanded by the Principal. Admission took place by Entrance examination, and the successful competitors proceeded for a year to Bangalore, where they were attached to a regiment to study language. After passing a satisfactory examination in this subject they were finally admitted to the College. Civilian candidates who were Matriculates were admitted without examination, but all others were tested in Arithmetic and English. The limits of age for civilians were 16 and 22. The course of study, which extended over two years, inclusive of vacations, comprised the subjects already enumerated for the First department, except Dynamics, Hydrostatics and Applied Mechanics, but carried to a lower standard, and in addition Language, viz., Tamil or Telugu. The hours of work were the same as for the First department. The half-yearly examinations and the plans carried one-fifth of the total marks. The final examinations were conducted in May by agency similar to that for the First department, and the marks were distributed as follows:—Mathematics 500, Engineering 400, Surveying 550, Drawing and Estimating 450, Language 100, Session work 500; total 2,500. The qualifying marks for a certificate as Supervisor were 35 per cent. of each of these six subject heads, and 60 per cent. of the total marks;

those for a certificate as Overseer 25 per cent. and 40 per cent., respectively. Students who failed were granted certificates as Draftsmen or Surveyors, if they displayed proficiency in the corresponding subjects. Independent candidates were permitted to present themselves for examination for certificates on payment of a fee of Rs. 15. The civilian students paid a fee of Rs. 3 monthly, and competed for five scholarships of Rs. 15 each, tenable during the second year of study. The Walker Scholarship, of Rs. 15, tenable for two years, was also available in this department. Scholarship-holders and military students paid no fees, and the latter were provided with books and instruments at the public expense. The passed men, including nearly all the military students, found employment mainly in the Upper Subordinate grades of the Public Works Department, from which a few of the Europeans were ultimately promoted to the superior establishment.

The Special department, which was divided into a Drawing class and a Surveying class, consisted entirely of civilians, who were admitted on the results of an Entrance examination in English and Arithmetic. The limits of age were 16 and 22, and the fee paid was Rs. 3 per mensem. The course in each class lasted two years. The marks at the half-yearly and final examinations were awarded by the College staff, and were distributed as follows:—*Drawing Class.*—Drawing from specification 100, Estimating 100, Copying 100, Session work 200; total 500. *Surveying Class.*—Chain, Compass, and Sextant Surveying 100, Levelling 100, Traversing with the Theodolite 100, Copying plans 100, Session work 300; total 700. Certificates as Draftsman or Surveyor were issued in three classes, the qualifying minima marks being *First class* 66 per cent. on each subject and 75 per cent. on the total, *Second class* 50 per cent. and 66 per cent., and *Third class* 33 per cent. and 50 per cent., respectively. Independent candidates were allowed to appear for the examination on payment of a fee of Rs. 7-8-0, and the certificate examinations were held by the College at out-stations as well as at Madras. Ten scholarships of Rs. 8 were tenable during the second year of study, five in each class. The working hours were from 10 A.M. to 3 P.M. for the Drawing class, and 11 A.M. to 3 P.M. with two mornings a week field work for the Surveying class. The passed men obtained employment mainly in the Public Works Deparment.

The First department was known as the "College," the Second and Special departments formed the "School." The course lasted two years for each of the four standards of training, viz., for Assistant Engineers, Overseers, Draftsmen and Surveyors. Candidates were admitted annually, so that the number of separate classes or "divisions" under instruction was eight. Each division of the First and Second departments devoted one morning a week to surveying field work, and each division of the Surveyors' class two mornings. A public prize distribution was held at the end of May, when the certificates were awarded to the Second and Special department pupils. The prizes consisted of books, and were all given to the Overseers' class. The Assistant Engineers passed out in December.

The year 1880 heralds the approach of an important crisis in the history of the College, as it saw the first step taken towards a complete reorganization of the institution, involving a development as wide as any that had been looked forward to by the earliest projectors. In

August the Principal submitted a scheme for improving the courses of instruction and rendering them more practical. It included independent in place of class field work by the students in surveying; practical work in setting out, bricklaying and well-sinking, cement testing, carpentry; the inspection of works in progress (a practice which had fallen into disuse); obligation on natives to qualify in a vernacular other than their own; the introduction of designing; an improved distribution of marks, &c. In the meantime the Director of Public Instruction had drawn the attention of Government to the orders of the Government of Bengal regarding the establishment of a Civil Engineering College at Calcutta, and suggested that the time had come for developing the Madras College. Colonel Macdonald advocated an extension of the course to three if not four years, the introduction of teaching in Mechanical, as distinguished from Civil Engineering, and the combination of practical with theoretical training. The Chief Engineer, Colonel Sankey, concurred in these views, and considered that "on all grounds the time had arrived for the introduction by "Government of a comprehensive scheme of technical Engineering "training suited to the requirements of the Presidency." His Grace the Duke of Buckingham remarked that it was in the direction of mechanical training that there seemed the greatest defect, and also the best opening for prospects of employment; that no expectations of extended service under Government should be held out, but that there was a promising field for the employment of trained mechanics under the Railway companies and other private employers, for which it was very desirable the natives of the country should be qualified. The Government referred the consideration of the whole question to a Committee presided over by Colonel Shaw-Stewart, the Consulting Engineer for Railways, and consisting of three members. The number was subsequently augmented, and the following gentlemen took part in the proceedings of 1881-82-83. Messrs. F. N. Thorowgood, F. H. Trevithick, D. Duncan, W. H. Wilson, H. C. West, Major H. M. Vibart, and Lieutenants W. L. C. Baddeley and H. D. Love, the last being Secretary. The Principal's scheme, mentioned above, was referred to the Committee, but the action of the Government showed that broader and more costly proposals were admissible, and Lieutenant Love drew up a note describing the constitution of the College, and furnishing a plan for giving effect to the suggestions of Colonel Macdonald. This note formed the basis of the Committee's deliberations.

In their first report, dated 4th April 1881, the Committee remarked that Government had "recognized the principle that technical edu- "cation should be afforded at the College not only to persons required "for the Public Works Department, but also to others desirous of "qualifying for work under the Railway companies or other private "employers." They advised that Mechanical as well as Civil Engineers should be trained, and that, in addition to the departments for Engineer Subordinates, Draftsmen and Surveyors, a class should be established for the mental improvement of skilled workmen. They urged the necessity of practical training in workshops and on works for both the Engineers and the Subordinates, and advised the extension of the theoretical courses for these students to three years and two-and-a-half years, respectively. The theoretical course was to be the same for the Mechanical as for the Civil Engineers; but, whereas the latter were subsequently to spend a year in the Public Works or other workshops followed by a year on Civil works, the former were to be stationed for two years in the largest workshops available, preferably those of the Madras and South Indian Railways. The Engineer Subordinates were to undergo a practical course similar to that for the Civil Engineers, the Committee remarking that they did not approve the practice recently introduced "of selecting for one year's practical "training only those pupils who will be required for permanent "employment in the Public Works Department, and of paying them "salaries from Educational funds which are disproportionate to their "position as students." The theoretical courses were to be extended and improved. That for the Engineers was to be brought up to the Cooper's Hill standard by the introduction of Algebraic Geometry and the Calculus; Chemistry, Physics and Geology; the Steam-engine, and Machine Construction and Drawing; Free-hand, Model and Perspective Drawing; and Vernacular language. Elementary Applied Mechanics, the principles of Mechanism, and Machine-drawing were to be added to the course for the subordinates. The name of the institution was to be changed to "College of Engineering." No fee was to be charged for the workshop year, and, during the final year's training, subsistence allowances of Rs. 50 and Rs. 25 *per mensem* to the Engineer classes for Europeans and natives, respectively, and Rs. 30 and Rs. 20 to the Subordinate class were to be paid to the students. The Committee advised that term examinations should be held at the end of each year, the results of which should count towards the final total, and that all examinations should be conducted by unpaid independent examiners. The military probationers were to study Mathematics as well as Language, and were to be transferred to the College from Bangalore for that purpose. The fee of the Engineer students was to be reduced to Rs. 10, and liberal scholarships were to be established in all the classes. It was recommended that two appointments annually as Assistant Engineer, Third Grade, should be guaranteed to the Engineer class; that in the Subordinate class notice should be given prior to each examination of the number of appointments as Overseer to be competed for; that the employment of any but certificated men in the Engineering establishments of Local Boards should be prohibited, and that the Surveyors and Draftsmen required for the Revenue Survey should hold College certificates. The Committee further advised that the Photographic class should be discontinued; that the sessions of the Engineer, Draftsman and Surveyor classes should commence in January, and that of the Subordinate class in August, so that all the classes might leave the College at the same period of the year; that a boarding house should be established near the College for the use of native students; and that physical training and field games should be encouraged. To provide for the higher standards and lengthened courses of instruction, the Committee advocated the appointment of a superior establishment, in addition to the Principal, of a Professor of Mathematics, a Professor of Engineering, and a Lecturer in Science; and they recommended that the junior staff should be strengthened and their salaries raised. The net cost of the scheme was estimated at Rs. 71,000, of which Rs. 10,000 represented allowances to students, and Rs. 10,000 premia and honoraria.

The Director of Public Instruction approved generally of the Committee's proposals, but considered that it would be desirable to make the theoretical and practical training contemporaneous, and to subordinate the College final examination to the University degree examination. He proposed some modifications also in regard to the age at admission, the scholarships, the pay of the staff, and other minor points.

The papers were then transferred to the Chief Engineer, who issued a minute putting forward a totally different scheme, which was admittedly based on departmental requirements alone. He advocated the formation of two classes educating to the standards required for Sub-Engineer and Overseer, respectively, thus repeating the proposal made by the Public Works Commissioners of 1852. Admission was to be open to Matriculates who could produce a certificate of having attended workshops and kept workmen's hours for a year, and who were able to walk twenty miles in six hours and to ride twenty-five miles in three-and-a-half hours. After a year's study at the College, the best students were to be transferred to the "First class" for two years further training, and subsequently examined for certificates as Sub-Engineer. The students who remained in the "Second class" were to study for a further period of a year-and-a-half, and were then to be examined for certificates as Overseer. Two Sub-Engineer and three Overseer candidates were to be guaranteed appointments as apprentices in the Public Works Department annually, and these passed students alone were to undergo a year's practical training on works. After "five or six years of thoroughly approved service," these persons were to be granted leave to appear for the B.C.E. degree examination of the University. The Chief Engineer, however, apparently overlooked the fact that Matriculates were not eligible to appear for the degree examination. At this time, the Government of India were proposing to guarantee a small number of Engineer appointments annually to the Indian Engineering Colleges, and Colonel Sankey recommended that the appointment expected to fall to Madras should become the reward of long and approved service in the Sub-Engineer grade. The Chief Engineer concluded his minute, which received the approval of several of the leading officers of the Public Works Department, by advising that all candidates for admission to the Draftsman and Surveyor classes should produce a certificate of having passed through a course, at the School of Arts, of Geometrical, Free-hand and Perspective Drawing.

The Principal of the College having made a remonstrance on behalf of the institution and of the cause of technical education, against these proposals, which involved the abolition of the Engineer class at the very time when the encouragement it had always needed was about to be given by the Supreme Government's guarantee, the question was again referred to the College Committee.

In March 1883 the Committee issued a second report dealing with the minutes of the Chief Engineer and the Director of Public Instruction. With regard to the former, they pointed out that Colonel Sankey's scheme would narrow the scope of the College to the extent of making it a mere school for the Public Works Department, that it not only did not contemplate the introduction of mechanical training, but involved the abolition of the existing Civil Engineer class, and that it excluded from an essential part of the course all students not destined for the Government service. The Committee remarked that the College "had now ceased to be a mere appanage of the Public "Works Department," that the experiment of employing natives in the Engineer grades had not received a fair trial, that a demand for professional men had arisen outside the Government service, that the fact of the capabilities of the College not having hitherto been fully utilized was due, in their opinion, to absence of encouragement and want of practical training, and that the adoption of the Chief Engineer's proposal regarding the guaranteed appointment would place this Presidency at a great disadvantage with the other provinces of India. On these grounds the Committee dissented from the views expressed by Colonel Sankey, and upheld their original report. With respect to the minute of the Director of Public Instruction, the Committee considered it would be impracticable to carry on the theoretical and practical training in alternate sessions as suggested by Mr. Grigg, and they expressed the opinion that the College would be abrogating part of its functions if it subordinated its final examination to the degree examination. On a few minor points they modified their views so as to meet those of the Director.

The Director of Public Instruction, in a note, dated 6th September 1883, approved generally of the Committee's scheme of training, but considered that the system of nomination to the Public Works Department of persons who had obtained College certificates should be abandoned, and that men should be admitted to the Upper Subordinate grades "by means of an independent competitive examination "tempered by selection." The examination for the grades of Sub-Engineer and Supervisor was to be open to all persons who held the Engineering degree, and who fulfilled certain conditions in regard to age, physique, practical work, &c. The tests for Overseers, Surveyors, and Draftsmen were to be regulated on similar lines. By this means there would be a dividing line between the establishment of Overseers on the one side and that of Supervisors and Sub-Engineers on the other, and Mr. Grigg observed that if the line could not be fixed in that position, he would make the degree the general test for admission to the Overseer grades.

The Chief Engineer, Colonel Shaw-Stewart, objected to this proposed open competitive examination on the ground that every candidate holding the degree must have previously passed through the College, must have undergone a searching final test there, and a further stringent examination for the University degree. The results of these examinations, in addition to certificates of practical fitness, rendered any further test superfluous. Colonel Shaw-Stewart considered that the open competition should take place at the time of admission to the College, not at the close of technical training. He suggested that the College courses of instruction should be arranged by the Public Works and Educational Departments jointly; that the final examinations should be conducted by a Board of Officers appointed by Government, the Principal being a Member of the Board, and that lists of candidates for the different grades of the Public Works Department should be prepared annually by the Principal in order of merit, and submitted to the Chief Engineer, with whom the final selection should rest. Colonel Shaw-Stewart deprecated the proposal to make the B.C.E. degree the qualification for admission to the Upper Subordinate establishment generally. He stated that, excluding the Surveyors and Draftsmen, there would then be only one class in the College, that such levelling up was undesirable, and that the Overseers would be educated above their station and their needs.

The Government, in July 1884, approved of the modifications proposed by Colonel Shaw-Stewart, and directed that a code of rules be drawn up by the Chief Engineer with the aid of the Principal. These regulations were sanctioned and published in July 1885, and were modified early the following year to nearly their present form. The new rules first took effect on candidates entering in January 1886.

Having thus touched briefly on the steps taken towards the reorganization of the College between 1880 and 1885, it is necessary to return to the earlier of those years, and to take up the current history of the institution.

Consequent on extensive reductions in the Public Works Department in 1879, an impression arose that the College was about to be abolished, and the numbers joining became so seriously diminished that Government considered it necessary, in April 1880, to dispel the doubts which existed regarding its stability.

In June Mr. Bradshaw was again appointed to act as an Inspector of Schools, his place being filled by Mr. M. Kenny, B.A., Headmaster of the Berhampore College. Mr. Bradshaw ultimately proceeded on furlough, and in 1884 retired, after a connection with the College of over twenty years.

In the annual report of 1879-80 the Principal urged the desirableness of rendering the courses of instruction more practical, and advocated their extension by six months, a proposal which was taken up by the Director in recommending measures for the reorganization of the College. The object was partially met in October 1880 by the appointment of apprentice Overseers, the number being limited to six annually. The apprentices were to receive a year's practical training on works, and were then to be received on the permanent establishment of the Public Works Department. In the course of 1880 Standing orders were drawn up for the guidance of students, and attendance became more regular owing to the operation of strict leave rules. An employment register was opened, and arrangements were made to assist passed students to obtain employment outside the Public Works Department.

The Warrant Officers of the Public Works Department, employed in the College, were ordered to be seconded. They were to be eligible for promotion up to the rank of Conductor, but would be required to revert to departmental duty prior to promotion to the Deputy Assistant Commissary grade.

In 1881 the Government of India decided that one-fourth of the average total number of vacancies in the Engineer establishment of the Public Works Department should be filled from the Indian Engineering Colleges from and after 1885. This arrangement gave six appointments for India, of which three were allotted to Roorkee, and one each to Madras, Poona and Calcutta. The appointments were to be made irrespectively of actual vacancies in the establishment, and were to be reserved for persons of pure Asiatic parentage. Appointments had been, for many years, guaranteed to the Engineer Class at Roorkee, but the new ruling proved a great boon to the Madras College.

In 1882 the Secretary of State alluded in a Despatch to the absence of practical training at the College as indicated by the annual report for 1881-82, and suggested that some arrangement should be made to enable Engineer students to obtain experience on works. The Madras Government referred the matter to the College Committee, which dealt with it in the manner already described.

The number of annual appointments as apprentice Overseers was raised to ten, and a new grade as apprentice Supervisor, to which five appointments were to be made annually, was instituted for the College First department. The apprentice system was, so far as the College was concerned, an imperfect one, since the practical training, the cost of which was to be charged to the Educational Department, did not form part of the regular course, and the men were paid at rates which were unsuitable to their position as students. It was nevertheless a measure of advantage for the College, as it materially affected the numbers joining. After the reductions in the Public Works Department in 1879, the College numbers had become seriously reduced; but they recovered with the appointment of apprentices, and by the year 1884 there were twenty-one students in the First department and forty-six in the Second. The Drawing and Surveying Classes contianed between them twenty-five. It was ultimately decided that the charge for apprentices should fall against the Public Works Department, the practical effect being that excess was incurred on the sanctioned scale for the Upper Subordinate establishment. The Supreme Government pointed out that in this establishment, numbering 185, the vacancies might be expected to amount to six annually. The Madras Government accordingly resolved in 1883 that the number of apprentice Overseers must in future be strictly limited to the wants of the department; that appointments must cease until the excess had become absorbed; and that, as direct nominations to the grade of apprentice Supervisor would tend to check the promotion of Overseers, such appointments would have to be very sparingly made. This order would doubtless have resulted in another cycle of depression in the First department had it not been for the Supreme Government's guarantee of an appointment to the Engineer establishment, which first came into operation in 1885. The Principal, in his annual report for 1882-83, urged the desirableness of preserving comparative uniformity in the number of appointments conferred from year to year, pointing out that the effect of sudden fluctuations in the strength of the Public Works establishment did not react on the department through the College until three or four years after the changes had been made, and that to preserve a constant supply of qualified men it was necessary to offer uniform encouragement. The Government of India suggested in 1883 that "it would be a good plan to hold out "prospects of good temporary appointments in the Public Works "Department to the students passing out of the College. It seems not "improbable that if it were generally known that employment on good "pay, avowedly carrying with it no claim to pension or guarantee of "continuance, but as a matter of fact fairly regular and continuous, is "to be obtained under Government in the Public Works Department, "a sufficiency of well-qualified applicants would soon be forthcoming,

"and that a want which is now felt would be supplied." Early in 1884 the Principal urged that trial should be made of local material on the numerous railway surveys and other projects which were then being undertaken, rather than that the Government staff of Assistant Engineers should be supplemented from other parts of India. A few passed men of the First department of the College were appointed temporary Surveyors in the Railway branch and on relief works, but on this, as on subsequent occasions, the easy course of obtaining the services of Assistant Engineers on loan from other provinces was naturally preferred to appointing young men from the College who would require to be taught their work. The South Indian Railway Company however tried, with satisfactory results, the experiment of appointing a native from the College to its Engineer establishment.

In the course of 1883 several improvements were effected in the College. The library catalogue was revised and printed, and the use of the library encouraged. The number of books issued, which was only 290 in 1880-81, had increased to 1,180 in 1883-84, and it gradually rose until it reached 2,700 in 1886-87. A text-book of rules and examples in Mensuration was compiled by the Second Assistant Master, Sub-Conductor Cames, and in this and subsequent years large additions were made to the collection of models and apparatus. In the previous year, 1882, a commencement had been made in the encouragement of field games by the provision of a lawn tennis court.

Down to 1884 admission to the Second department had been regulated by a College Entrance examination, except in the case of matriculates. The number of applications was now, however, so large that it became necessary to reserve portions of the vacancies for these two classes of candidates, the passed and unpassed. Thereafter it was decided that matriculates only should be admitted, thus anticipating one of the measures recommended by the College Committee. It became increasingly difficult for the Principal to obtain the services of independent examiners, and Captain Love represented the urgent need for the appointment of a paid Board of officers to be nominated by Government. The request was acceded to, and a Board, consisting of a President and two Members, to remain in office three years, was sanctioned. The Board, with Major Coaker as President, first fulfilled its functions at the examination of December 1885, when eight First department students were tested, all of whom passed. The certificate examinations for Surveyors and Draftsmen continued for a time to be conducted by the College staff. In due course the Board was strengthened by the addition of Assistant Examiners for Science, Language, &c.

In 1884 sanction was accorded to the introduction of a permanent establishment of twenty-five Sub-Overseers, the vacancies being filled as far as possible by men "who had passed out of the Civil Engineering College, and who had had some practical experience." The appointments rested with the Superintending Engineers of Circles. In the same year the Government of India ordered that the number of appointments available for Indian Colleges should be increased to eleven, and that all students coming under the statutory definition of natives of India should be eligible to compete. The appointments were to be distributed as follow:—Roorkee four and five alternately, Calcutta

student to profit by the guarantee was Mr. S. A. Subrahmanya Aiyar, B.A., B.C.E., who passed out in December 1884.

In 1885 the Madras Survey Department opened its ranks to College students, senior pupils being admitted as Head Surveyors on Rs. 100, and junior pupils as Deputy Surveyors on Rs. 50. Both classes were eligible to rise to the grade of Sub-Assistant Superintendent on Rs. 250. The revised course for Surveyors under the new scheme was arranged to meet the requirements of the Survey as well as those of the Public Works Department. It was also provided that soldier students, whose appointment to the Public Works Department was now limited to three annually, might be entertained in the Survey as Head Surveyors, drawing the usual outfit allowance, and being eligible for promotion to warrant grade. From this year the College prizes consisted of various useful instruments instead of books.

Towards the end of the year Mr. Grigg submitted a scheme to encourage technical education by inaugurating examinations and scholarships in Science, Art and Industrial subjects. The teaching power was to be found in the Civil Engineering and Agricultural Colleges, and in the School of Arts. The first named was to provide instruction in Civil Engineering, Machine Construction, Steam, and Electrical Engineering, and the examinations in Engineering subjects were to replace those conducted by the College Board. The Government approved generally of the scheme, but stated that they did not desire "that any measures "should be taken towards extending the scope of the work done at the "Engineering College. That institution was now providing a sound "Engineering education, and its further development might be left to "the future." In due course the proposed public examinations were instituted, and though not compulsory for College students, they have proved of advantage to them by rendering additional scholarships available in Engineering subjects. The Secretary of State remarked in his despatch of 5thNovember 1885, that the general efficiency of the institution and its increasing popularity were very satisfactory.

The College reorganization scheme was finally ordered to be introduced from 1st January 1886, and Captain Love was permitted, in view of it, to visit and examine the working of the Engineering Colleges at Calcutta, Roorkee and Poona. The experience gained in the tour contributed to the satisfactory settlement of details of the new scheme. All candidates admitted after 1st January 1886 joined under the new rules, so that from this date until the middle of 1887 the two sets of regulations operated contemporaneously. During this period the College numbers were abnormally increased owing to the change in the time of admission to the Draftsman and Surveyor classes. The total number of students on 31st March 1886 was 175. The Entrance examinations in Mathematics for the Engineer and Engineer Subordinate classes were opened to candidates who had passed the First Arts and Matriculation examinations respectively, a proportion of the University marks being allowed to count towards the total. Fees of Rs. 20 and Rs. 10 were payable. These examinations, as also the final and term examinations, were conducted by the Board of Examiners. Candidates for the Draftsman and Surveyor classes became eligible for admission on passing the Middle School or some superior examination, selection proceeding from higher to lower qualifications. Replacing the bursaries of the old rules, three scholarships of Rs. 30 each became available

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The College reorganization scheme was finally ordered to be introduced from 1st January 1886, and Captain Love was permitted, in view of it, to visit and examine the working of the Engineering Colleges at Calcutta, Roorkee and Poona. The experience gained in the tour contributed to the satisfactory settlement of details of the new scheme. All candidates admitted after 1st January 1886 joined under the new rules, so that from this date until the middle of 1887 the two sets of regulations operated contemporaneously. During this period the College numbers were abnormally increased owing to the change in the time of admission to the Draftsman and Surveyor classes. The total number of students on 31st March 1886 was 175. The Entrance examinations in Mathematics for the Engineer and Engineer Subordinate classes were opened to candidates who had passed the First Arts and Matriculation examinations respectively, a proportion of the University marks being allowed to count towards the total. Fees of Rs. 20 and Rs. 10 were payable. These examinations, as also the final and term examinations, were conducted by the Board of Examiners. Candidates for the Draftsman and Surveyor classes became eligible for admission on passing the Middle School or some superior examination, selection proceeding from higher to lower qualifications. Replacing the bursaries of the old rules, three scholarships of Rs. 30 each became available

"and that a want which is now felt would be supplied." Early in 1884 the Principal urged that trial should be made of local material on the numerous railway surveys and other projects which were then being undertaken, rather than that the Government staff of Assistant Engineers should be supplemented from other parts of India. A few passed men of the First department of the College were appointed temporary Surveyors in the Railway branch and on relief works, but on this, as on subsequent occasions, the easy course of obtaining the services of Assistant Engineers on loan from other provinces was naturally preferred to appointing young men from the College who would require to be taught their work. The South Indian Railway Company however tried, with satisfactory results, the experiment of appointing a native from the College to its Engineer establishment.

In the course of 1883 several improvements were effected in the College. The library catalogue was revised and printed, and the use of the library encouraged. The number of books issued, which was only 290 in 1880-81, had increased to 1,180 in 1883-84, and it gradually rose until it reached 2,700 in 1886-87. A text-book of rules and examples in Mensuration was compiled by the Second Assistant Master, Sub-Conductor Cames, and in this and subsequent years large additions were made to the collection of models and apparatus. In the previous year, 1882, a commencement had been made in the encouragement of field games by the provision of a lawn tennis court.

Down to 1884 admission to the Second department had been regulated by a College Entrance examination, except in the case of matriculates. The number of applications was now, however, so large that it became necessary to reserve portions of the vacancies for these two classes of candidates, the passed and unpassed. Thereafter it was decided that matriculates only should be admitted, thus anticipating one of the measures recommended by the College Committee. It became increasingly difficult for the Principal to obtain the services of independent examiners, and Captain Love represented the urgent need for the appointment of a paid Board of officers to be nominated by Government. The request was acceded to, and a Board, consisting of a President and two Members, to remain in office three years, was sanctioned. The Board, with Major Coaker as President, first fulfilled its functions at the examination of December 1885, when eight First department students were tested, all of whom passed. The certificate examinations for Surveyors and Draftsmen continued for a time to be conducted by the College staff. In due course the Board was strengthened by the addition of Assistant Examiners for Science, Language, &c.

In 1884 sanction was accorded to the introduction of a permanent establishment of twenty-five Sub-Overseers, the vacancies being filled as far as possible by men "who had passed out of the Civil Engineering College, and who had had some practical experience." The appointments rested with the Superintending Engineers of Circles. In the same year the Government of India ordered that the number of appointments available for Indian Colleges should be increased to eleven, and that all students coming under the statutory definition of natives of India should be eligible to compete. The appointments were to be distributed as follow:—Roorkee four and five alternately, Calcutta two and one alternately, Madras one, Poona two. The first Madras

student to profit by the guarantee was Mr. S. A. Subrahmanya Aiyar, B.A., B.C.E., who passed out in December 1884.

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for the Engineer class, one for each division; six of Rs. 10 in the Engineer Subordinates class; two of Rs. 8 in the Draftsman class; and two of Rs. 8 in the Surveyor class. The scholarships were first awarded on the results of the Entrance examinations, and were subject to re-distribution after each term examination, so that all were tenable for a year, except that falling to the junior division of the Engineer Subordinate class which could be held for six months only. The rules regarding military students were subjected to as little modification as possible. The designation of the institution was, in view of the mechanical training to be given, changed to College of Engineering. The monthly fee-rate for the Engineer class remained at Rs. 16, but the rates for the Engineer Subordinate and junior classes were raised to Rs. 6 and Rs. 4, respectively. The payment of half-yearly term fees, however, at Rs. 85, Rs. 30 and Rs. 18 was optional, or a student might compound for the whole theoretical course by a payment of Rs. 400 in the Engineer class or Rs. 125 in the Engineer Subordinate class. To ensure the possession of books and instruments of sufficient number and quality it was made compulsory on students to deposit Rs. 100 each in the Engineer class, Rs. 75 in the Subordinate class, and Rs. 50 in the junior classes with the Principal, to be drawn against for requirements. To these reforms the reorganization was at the outset limited. Without extended accommodation and additional superior establishment for teaching it was impossible to do much towards instructing an increasing number of classes in a variety of new subjects; and in his report for 1885-86, the Principal represented the pressing need for additional buildings and staff. In 1885, consequent on increased space being needed at Chepâk for the Survey and Forest officers, the Government ordered the preparation of plans and estimates for the construction of a new Engineering College to be situated between the Public Works offices and the Presidency College. The work was undertaken by the Consulting Architect, Major Morant, but the cost, three lakhs, was considered prohibitive, and it was decided that the existing building should be extended on the south side at about one-third of the cost. The Principal having stated that two large halls to serve as drawing office and museum were indispensable, together with three lecture rooms and a chemical laboratory, Mr. Chisholm, the Consulting Architect, drew up plans handsomely providing for these requirements, at an estimated cost of Rs. 90,000, with Rs. 5,000 for furniture and fittings. They received sanction towards the end of 1886, and the work was put in hand without delay. Proposals regarding the staff were submitted early in 1886, but were not sanctioned until 1888. They will be referred to later. In the meantime Mr. Kenny, the First Assistant Master, was transferred to Berhampore, his place being taken, pending the appointment of a Professor of Mathematics, by Mr. T. R. Scott, B.A. A Librarian and Storekeeper was appointed in July to carry out duties which had hitherto been conducted by one of the Assistant Masters. To provide for physical training, the hours of in-door study were slightly curtailed, and sanction was obtained for the ground on the west side, between the College and canal, to be reserved for a gymnasium and lawn tennis ground. The right to use for recreative purposes the area on the east side lying between the College and Beach road was also conferred. Systematic instruction in gymnastics was commenced in 1888. The hours for the Draftsman and Surveyor classes were extended to synchronize with those of the senior classes.

In September 1886 a class was formed, at the request of the Superintendent of the Madras Survey, for the instruction in Mathematics of the young officers of the department. A special teacher was appointed, who was paid from the fees of the pupils. The half dozen probationers forming the class qualified in due course, but as no fresh officers joined, the class lapsed in the course of the following year.

In March the Principal pointed out that, owing to the increase in the length of the theoretical course from two years to three, there would be no 1887 batch of Engineers leaving the College, and that one of the guaranteed appointments would therefore lapse. He recommended that two appointments instead of one should be conferred on the 1888 batch, and that, in view of the improved courses of instruction, two appointments should be awarded every third year. The Government approved these proposals, and the first of them was ultimately sanctioned by the Government of India.

Having drawn up syllabuses of the new courses of instruction, submitted proposals regarding the staff, and generally placed matters in train connected with the reorganization, Captain Love, in March 1887, proceeded on furlough to Europe, his place being temporarily filled by Captain C. B. Henderson, R.E., from the Public Works Department. In the course of the year there was a considerable fall in the College numbers, which was attributed by the Acting Principal to recent reductions in the temporary establishment of the Public Works Department. The event of the year was the sanction of the new establishment. Detailed proposals had been submitted to the Madras Government early in 1886. In forwarding these, the Director of Public Instruction stated that the object of the reorganization was to "enable the College to educate Mechanical Engineers, to improve the "course of study in the several branches already taught, to extend the "benefit of the instruction given to those who seek employment "under railway and other employers of labor, to afford special means "of instruction for the maistry class, and generally to adapt the "College to taking a more important position than heretofore in promoting technical education in such other ways as may hereafter "be found practicable." The scheme provided for two Professors of Mathematics and Engineering, who would, in addition to their special subjects, undertake between them the Science teaching; two Instructors for Engineering, Surveying and Drawing on Rs. 200—300; five Assistant Instructors for Surveying and Drawing on salaries ranging from Rs. 75—100 to Rs. 150—200; two Vernacular Assistants on Rs. 60—80; and Instructors in Gymnastics and Bricklaying on Rs. 20—40. The salaries were all to be progressive. Mr. Grigg suggested that the appointment of Principal, hitherto always held by an Officer of Royal Engineers, might eventually, together with the proposed Professorships of Mathematics and Engineering, belong to the graded Educational service. The Government, however, while approving the other parts of the scheme, objected to the specialists who would form the superior establishment being placed on the graded list, and they ruled that the office of Principal should invariably be held by an Engineer. They directed that the staff proposals should be referred to the Secretary of State, and that, pending the receipt of his orders, no changes should be made in the salaries of any of the officers composing the existing establishment. On 31st August 1887 the Secretary of State addressed the Government of India as follows:—"An alteration in the staff is evidently necessary for the full development of the scheme introduced last year for enlarging the scope of "the College, with the object of facilitating the spread of technical "education in Madras, and I agree with your Excellency that the "proposals just put forward by the Madras Government seem calculated to meet the necessities of the case at a moderate cost. I "accordingly approve of the scheme in question, and sanction its "introduction as such time as the Government of Madras may think "it advisable." The Secretary of State, however, subsequently ruled that the Professors of Mathematics and Engineering should be placed on the graded list.

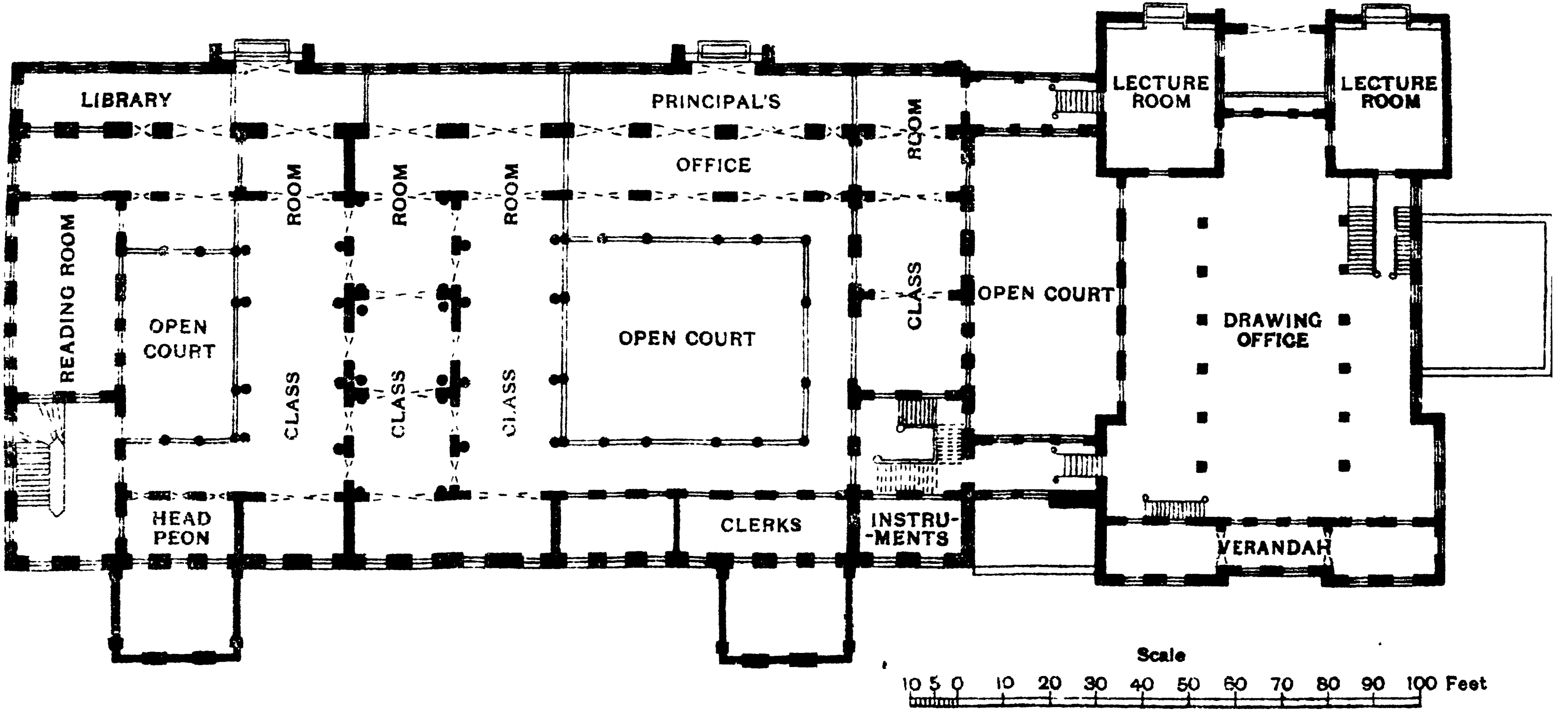
In May 1887 the last of the students under the old rules passed out of the College. The work done by the institution since 1859 may be summed up by the total number of successful pupils. The number of independent candidates who obtained certificates is also given, as the great majority received originally their training at the College. The total number of diplomas and certificates issued was 1,896, divided as follows:—(1) Engineers: 87 direct from the College and 3 others; (2) Overseers: 627 direct and 127 others; (3) Draftsmen: 389 direct and 311 others; (4) Surveyors: 249 direct and 103 others. Lists of the certificate-holders will be found in the College calendar. The Principal has, since 1865, conducted for the Government of India the local examination for admission to the subordinate division of the Accounts branch, Public Works Department. The papers are set by the College, and the examiners are remunerated from the candidates' fees. The number of certificates of qualification issued down to 1892 was 275.

The introduction of the revised establishment was sanctioned as regards the junior staff from 1st January 1888, and the nomination of the new Professors was left to Sir Alexander Taylor, Sir Philip Magnus and Professor Unwin. In the following June the Secretary of State intimated that Mr. A. Chatterton, B.Sc., of the University of London, and Mr. E. W. Middlemast, B.A., of St. John's College, Cambridge, had been appointed to the fourth class of the Madras graded Educational service on salaries of Rs. 500—750. These gentlemen joined the College in July and August respectively. From this time the reorganization may be said to have been completed and teaching in the new subjects to have commenced. The gymnasium was completed during the year 1888, and an Instructor appointed. Teaching in Photography, which had been carried on to a limited extent since 1862, was discontinued.

In August 1888 the new buildings were occupied. They comprised a drawing office and examination hall, lofty and well lighted measuring 70 feet by 60 feet, the roof being carried on plate girders Along the sides of the hall run galleries supported on cast iron columns, and above are clerestory lights. This hall and two lecture rooms, are on the upper floor of the new block. On the ground floor are a chemical laboratory and a third lecture room, with a museum

COLLEGE OF ENGINEERING - MADRAS

PLAN OF UPPER FLOOR



COLLEGE OF ENGINEERING - MADRAS

PLAN OF LOWER FLOOR

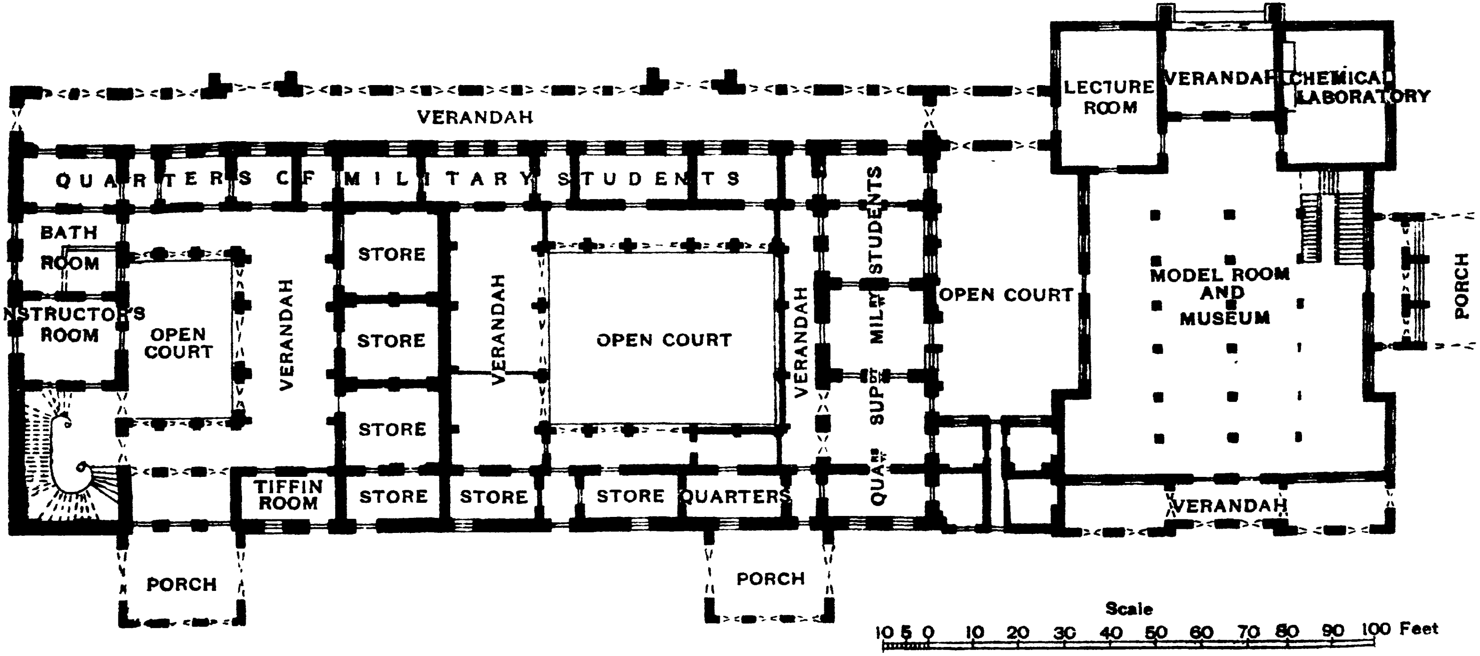


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Photo-Zinco., Survey Office, M
1893.

and model room corresponding with the drawing office above. The ceiling of the model room is supported on two rows of stone pillars and a central row of cast iron columns. The exterior is in the Indo-Saracenic style in keeping with the rest of the Chepâk buildings. The work was carried out by Mr. Brassington, the Consulting Architect to Government.

At the examinations of December 1888 failures were numerous, owing partly to the revised curricula being enforced from a date two-and-a-half years anterior to the appointment of the corresponding staff. In consequence of these failures, of the increased duration and difficulty of the courses, and of the enhanced fees, the College numbers continued to fall off until, in February 1889, they had diminished to 90. The successful students of the Engineer and Engineer Subordinate classes joined the Public Works Workshops in March, but the Government notified that the two appointments sanctioned for this batch of Engineers would not be conferred until after the completion of the practical course of two years. Early in 1889 the Chief Engineer objected to the College rule requiring that the number of vacancies for each batch of Engineer Subordinates should be announced annually before the commencement of their practical course. The Government, however, overruled the objection, and stated, at the same time, that passed men of the Engineer class should not be "allowed a preference "in the Upper Subordinate ranks over men who have been expressly "trained for that grade."

During the year 1889 considerable progress was made. An evening class for Maistries and Artisans was formed with twenty-five students, and instruction was conveyed in Arithmetic, Geometry, Mensuration, Building Construction, and elementary Plan-Drawing.

The practice of confining the surveying field work of the different classes to the early morning was discontinued, and each class had a full day each week set apart for this work, except during the months of April and May. The Surveyor class was allotted two days per week. The classes were divided into small squads working independently, and the amount of work executed by each student was enormously increased. Practice in the gymnasium was made compulsory for all classes, and the chemical laboratory was opened to the Engineer students for experimental work. Sanction having been obtained to establishing a small workshop, benches, vices, tools, a small lathe, and a portable forge were purchased, and work was commenced by the Engineer and Engineer Subordinate classes in August. Time was found by appropriating one morning per week for each division, and the Wednesday holiday. The Bricklaying Instructor was pensioned, and an Instructor in Carpentry and Fitting, selected from the South Indian Railway shops, was appointed in his place on a salary of Rs. 30—45. Space was found temporarily for the workshop in vacant quarters belonging to the military students, and estimates were submitted for the construction of permanent shops and an experimental laboratory.

Engraved medals, in gold for the Engineer and Engineer Subordinate classes, and in silver for the Draftsman and Surveyor classes, as authorized by the new rules, were issued to the most distinguished students of 1888. In 1889 the Principal obtained sanction for the preparation of dies from designs by Colonel W. S. Hunt for a medal to be issued ingold for the Engineer class, in silver for the Engineer Subordinate class, and in bronze for the Draftsman and Surveyor classes. A prize, of the annual value of Rs. 24, to consist of books, was founded by certain old students of the "Second department" of the College as a memorial of Major-General H. T. Rogers, some time Principal, and at the end of the year Rajah Sir T. Madhava Rau, K.C.S.I., established three prizes, each of the annual value of Rs. 20, to be assigned for the encouragement of some branch of practical training. The syllabuses were revised, and received the sanction of Government. They will be found in the calendar, which was issued for the first time in 1889. The College numbers rapidly improved, a division of 20 students being admitted to the Engineer Subordinate class in August 1889, while in January 1890 divisions of still greater strength joined the Draftsman and Surveyor classes, and 30 candidates were admitted to the Artisan class.

During the next three years, the College more than regained its former popularity, the numbers rising to upwards of 200, exclusive of the students going through the practical courses. The Engineer class represented about 15, the Subordinate class 70, the Draftsman and Surveyor classes 50 and 40 respectively, and the Artisan class 40. The applications for admission were so numerous, excepting for the Engineer class, that ample selection was possible, and marked improvement was observed in the educational status of the students. The Artisan class continued to be popular, but only a small proportion of the pupils were actual handicraftsmen. The courses of study were rendered as practical as possible. The College workshop was fully utilised, the students being employed in chipping, filing, turning and screw-cutting in iron, and in sawing, planing, and making tables and other College furniture in wood. Plans were drawn up for a new workshop and experimental laboratory to be constructed at the South end of the College building, and these received sanction and were commenced in 1892. The shop will contain machine tools driven by steam, and a large testing machine. From August 1889, chemical laboratory work was undertaken by the Engineer class. This class was further exercised in cement-testing, taking indicator diagrams, and in using various experimental apparatus designed for the most part by Mr. Chatterton. In 1891 the Engineer class and in the following year, the senior divisions of the Subordinate and Surveyor classes went out into camp for survey field work at a distance from Madras. Marks were awarded by the College for practical work, the proportion being raised as the amount of such work increased. The bulk of the marks is given, however, by the Board of Examiners for examination work.

In December 1890 the first batches of Engineer and Subordinate students completed their practical training under the new scheme. During the workshop course of one year, they spent three months in the Carpenter's shop, and were then passed in turn through the Lathe, Filer's and Smith's shop, the Instrument department, and the Foundry, ending with the working of a stationary engine. During the works course, they were attached to various circles where important public works were in progress. One of this batch of Engineer students, V. Devaisikhamuni Pillai, spent his second year in the Madras Railway Locomotive shops, and qualified as the first Mechanical Engineer. Due attention was paid to physical training and field games. The clubs for cricket and lawn tennis received encouragement, and drill was introduced in connection with the gymnastic practice.

Early in 1891 the Principal proceeded to England for temporary duty at Chatham, his duties being taken over by Major A. W. Smart, R.E. Conductor W. Cames, and Sergeant W. H. Goddard, the Instructors in Engineering and Surveying and Drawing, respectively, were transferred from the Public Works list to the Upper Subordinate Educational service. Major H. D. Love relieved Major Smart early in 1892, and shortly afterwards Mr. Chatterton, the Professor of Engineering, was transferred temporarily to the Public Works Department for two years to gain experience of irrigation and other details. His place was occupied by Mr. J. J. Whiteley, an Executive Engineer of the Public Works Department. The scholarships in the Engineer Subordinate class were increased to Rs. 12–8–0, but were made available only after six months' residence. The University marks ceased to be credited to the entrance examination totals and the examinations for admission were made to embrace English as well as Mathematics.

In 1892 the Government of India resolved that there should be a Public Works Provincial as well as Imperial service, and that the former should be recruited in India. The appointment of Engineers to the Madras list is to be one apprentice annually direct from the College, and, in alternate years, one selected from the Sub-Engineer grade of the Upper Subordinate establishment of the department. The new regulations were not applicable to students who had, at the time of the publication of the rules, already entered the college. The Madras Government, at about the same time, decided on the removal of the restriction regarding the permanent employment of passed Engineers in the subordinate ranks of the department.

The services of Conductor W. Cames, which had been given to the College for upwards of twenty years, were lost by his death early in 1893. His place was filled by the temporary transfer of Sergeant B. O Reynolds from the Public Works Department. The buildings for the new Workshop and Engineering Laboratory were completed, and the erection of the shafting and machinery commenced. The shops were formally opened by H.E. Lord Wenlock at the Prize distribution of February 1894, when the centenary of the institution was celebrated. Later in that year a European Workshop Instructor, and a second native assistant were appointed.

In 1894 the University examination for the degree of Bachelor of Civil Engineering was held for the last time, and that for the degree of Bachelor of Engineering for the first. The course for the new degree is analogous to that laid down for the College Engineer class under the new rules, and two examinations are required. The First examination in Engineering comprises Mathematics and Drawing; the second, or degree examination, embraces two branches, a Civil and Mechanical, in either of which candidates may proceed to their degree. In April 1894 the Principal took furlough for a year, his place being filled for seven months by Lieutenant-Colonel A. W. Smart, R.E., and by Mr. J. P. Davidson, Executive Engineer, Public Works Department, for five. Mr. Middlemast, the Professor of Mathematics, was transferred to Kumbakonam College as Principal, being relieved by M.R.Ry. B. Hanumantha Rau. During the year a competitive examination was instituted for admission to the Draftsman and Surveyor classes; and the students of the Engineer and Engineer Subordinate classes were required to take a course of riding during their workshop year. The recreation club was placed on a satisfactory footing, and membership was made compulsory. A suitable recreation ground for cricket and football had been secured during the previous year on the west side of the canal. A College manual on Building Construction, compiled by Sergeant B. O. Reynolds, the Instructor in Engineering, was published.

During 1895, orders were issued for the reduction of the practical courses from two years to one, the Chief Engineer deciding in individual cases on the division of the period between workshops and works. It was also decided to shorten the probationary course of the soldier students from one year to six months, and to abolish it altogether after 1898. Encouragement was given to the Engineer class by the reduction of the tuition fees from Rs. 16 to Rs. 12 per mensem, and by the increase of scholarships from three of Rs. 30 to nine of Rs. 15, tenable in all cases for one year, three in each division of the class.

H. D. L.

1896.

College of Engineering, Madras.

I.—RULES RELATING TO THE CONSTITUTION OF THE COLLEGE OF ENGINEERING.

Preamble.—The College, which is affiliated to the Madras University, affords theoretical and practical instruction in subjects qualifying Europeans and Natives of India for the professions and callings set forth in Article III, in view of fitting them for employment in such capacity by Government, by Local and Municipal Boards, and by other agencies.

Students passing the higher course in Engineering are at the same time prepared for the B.E. degree Examination of the Madras University.

ARTICLE I.

The responsibility for the discipline and management of the College is vested in the Principal, under the control of the Director of Public Instruction.

ARTICLE II.

The admission and all final examinations will be conducted by an independent Board of Examiners, consisting of a President and two Members, to be appointed by Government for a term of three years. They shall receive such remuneration as shall from time to time be fixed by Government. When necessary, the Board may, with the sanction of Government, employ assistant examiners. The decision of the Board of Examiners in regard to the qualifications of any student appearing for examination shall be final. The names of all students declared by the Board to have passed a final examination shall be published in the *Fort St. George Gazette.* After completing the annual examinations the Board shall submit a report to Government through the Director of Public Instruction, summarising the results of the examinations. They may record in the report any observations of a general nature bearing on the working of the College, or make any suggestions they consider expedient, provided such observation or suggestion arise naturally out of the examination work which the Board have to perform. The report shall be signed by the President and Members of the Board.

ARTICLE III.

The classes to be formed are for the training of

(1) Civil Engineers.
(2) Mechanical Engineers.
(3) Engineer Subordinates.
(4) Draughtsmen.
(5) Surveyors.
(6) Maistries and Artisans.

ARTICLE IV.—ADMISSION.

(1) The number of students to be admitted annually will ordinarily be limited to 15 in the Civil and Mechanical Engineer classes taken together; to 30 in the class for Engineer Subordinates; to 25 in the class for Draughtsmen; to 20 in the class for Surveyors; and to 30 in that for Artisans.

Admissions shall be once a year—(1) For the Engineer classes, the last Monday in January; (2) for the Engineer Subordinate class, on the first Monday in July; (3) for the Junior classes, on the last Monday in January.

(2) Candidates for admission to the Civil and Mechanical Engineer classes should be between the ages of 17 and 21 years, to the Engineer Subordinate class between the ages of 16 and 20 years, and to the other classes between the ages of 16 and 22 years, on the 31st December preceding the year of admission. Candidates otherwise qualified, but whose ages exceed the maxima above laid down, may be admitted with the sanction of the Director of Public Instruction if the strength of the several classes permits. Students so admitted shall be ineligible for guaranteed appointments, and for prizes and scholarships.

(3) Candidates for admission to the Civil and Mechanical Engineer classes must produce a certificate of having passed the first Examination in Arts of the Madras or other Indian University; to the Engineer Subordinate class, a certificate of having passed the Upper Secondary Examination, or the Matriculation Examination of the Madras or other Indian University; to the Draughtsman and Surveyor classes, except when specially exempted, a certificate of having passed the Lower Secondary, or the late Middle School Examination. For the sixth class selection will be made from the sons of artisans or maistries, or from youths who have already had practical training in some of the building trades.

(4) All candidates must produce satisfactory testimony of good character, physical fitness, age, and freedom from the liability to small-pox. Candidates whose certificates are unsatisfactory in any respect will be excluded.

(5) Admission to the Civil and Mechanical Engineer Classes shall be decided by a Competitive Examination in the following subjects:—

	Marks
Arithmetic (the whole)	100
Algebra (including quadratic equations and the binomial theorem)	75
Geometry (the first four books and the sixth book of Euclid)	75
Mensuration	50
Trigonometry (including the solution of plane triangles)	100
English Composition	80
Hand-writing (to be judged from the manner in which the English Composition is written) ..	60
Total ..	540

Candidates failing to obtain 40 per cent. of the total marks shall not be admitted.

Selection shall be made in order of merit: provided that, if four Europeans and Eurasians and three Muhammadans are not within the first fifteen, the number under each may be made good in order of merit from the other qualified candidates belonging to these classes. When they have been two years in the College, students shall inform the Principal whether they intend to be Civil or Mechanical Engineers.

(6) The fee for admission to this examination shall be Rs. 20. The names of the successful candidates shall be published in the *Fort St. George Gazette.*

(7) Admission to the Engineer Subordinate class shall, except in the case of soldier students, be given preferentially to candidates who have passed the First Arts Examination of the Madras or other Indian University, or the Upper Secondary Examination. The admission of Matriculates shall be decided by open competition in the following subjects:—

	Marks.
Arithmetic (the whole)	125
Algebra (including quadratic equations)	75
Geometry (the first four books of Euclid)	100
English Composition	80
Hand-writing (to be judged from the manner in which the English Composition is written)	60
Total ..	440

(8) Matriculates failing to obtain 40 per cent. of the total marks shall not be admitted. Selection shall be made in order of merit: provided that, if six Europeans and Eurasians and four Muhammadans are not within the first twenty-five qualified candidates, the number under each may be made good in order of merit from the other qualified candidates belonging to these classes. The fee for registration or examination shall be Rs. 15. The names of the selected and successful candidates shall be published in the *Fort St. George Gazette.*

(9) *Soldier Students.*—Non-commissioned officers and soldiers of Her Majesty's British service desirous of qualifying for employment in the Public Works Department will, to the number of five annually, be admitted to the College on passing a Competitive entrance examination in arithmetic and English. After six months' study of arithmetic, algebra, geometry, and vernacular language, they will, provided they pass a satisfactory examination in these subjects, join the Subordinate class for the ordinary theoretical and practical courses. Each student will draw a stipend of Rs. 10 per mensem for three and-a-half years, commencing from the date of joining the Subordinate class. His pay, rations and clothing will be drawn from his regiment throughout the whole course of study. A fixed proportion between the number of soldiers and civilians to be appointed to the Public Works Department will be established.

* (10) Admission to the Draughtsman and Surveyor classes shall be regulated by the order in which the candidates have passed the late Middle School, Lower Secondary, or some higher examination, the

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*** *N.B.*—Entrance to these classes is now by open competition— *vide* Rules of Admission (3) and (4), Part II.**

selection proceeding from those that have passed a higher examination to those who have passed a lower.

ARTICLE V.—COURSES.

The course and subjects of study in the several classes shall be as follows:—

(1) CIVIL AND MECHANICAL ENGINEER CLASSES.

(*a*) THEORETICAL COURSES.—The theoretical course, which extends over three years, will embrace the following subjects, which carry the marks enumerated against each below:—

		Marks.
I.	*Pure Mathematics.*—Algebra, geometry and arithmetic; mensuration and trigonometry; algebraic geometry, and the differential and integral calculus	475
II.	*Science.*—Mechanics; hydromechanics; chemistry; physics and geology	525
III.	*Engineering.*—Building materials; building and bridge construction; hydraulics, irrigation works and sanitary engineering; road and railway construction; applied mechanics; principles of mechanism; prime movers; the steam-engine	775
IV.	*Drawing.*—Geometrical drawing; free hand, model and perspective drawing; building drawing; machine drawing; estimating; designing; specification	500
V.	*Surveying.*—Surveying with chain, compass and plane table; levelling; theodolite surveying; topographical drawing	400
VI.	*Language.*—Tamil or Telugu [*]	200
VII.	*Drills and Exercises.*—Physical fitness; gymnastics, &c.	125
	Final Total	3,000

Of the total marks, 2,400 shall be awarded by the Board of Examiners for examination work, and 600 by the College Staff for drawings, notes, field-work, work in the workshops, chemical laboratory, &c., executed during the course. The Board, however, shall call for and inspect such drawings, notes, &c., before finally accepting the marks given by the staff.

Term examinations will be held at the end of the first and second years of study, at which portions of the above subjects will be finally disposed of by the Board of Examiners. The marks awardable at these examinations are included in the final total.

Candidates must obtain one-third of the total marks in each of the subject heads I, III, IV, and V, one-fourth in each of the subject heads II, VI and VII, and one-half of the final total marks They shall be arranged in two classes in order of merit; the first, or honour class, containing those who have obtained not less than three-fourths of the total marks.

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[*] Tamil to be obligatory for natives whose mother tongue is Telugu, and *vice versâ*. The choice of one of these two languages to be open to all other students.

(*b*) PRACTICAL COURSE—*Civil Engineers.*—After completing the theoretical course, the pupils of the Civil Engineer class will spend one year in the Public Works Workshop, going through the carpenters' shop, the smithy, the foundry, and the fitting shop or they will be placed for one year under the Public Works Department, and will be stationed at places where large works are in progress. They will be regularly instructed in the practical details of brick-making, bricklaying, quarrying, blasting, masonry, building of all sorts, the management of labour, accounts, &c.

Mechanical Engineers.—The course will comprise two years of practical study at one of the chief workshops of the Presidency.

N.B.—During the first year in the workshops, there will be a short course in riding. The charges to be met by each student will be about Rs 30.

(2) ENGINEER SUBORDINATE CLASS.

(*a*) THEORETICAL COURSE.—The theoretical course, which extends over two and-a-half years, will embrace the following subjects, which carry the marks enumerated against each below :—

		Marks.
I	*Mathematics.*—Arithmetic, algebra and geometry; plane trigonometry and mensuration; elementary statics	370
II	*Engineering.*—Building materials; strength of materials; building and bridge construction ; earth-work and roads; hydraulics and irrigation works; elementary applied mechanics ; mechanism and the steam-engine	600
III.	*Drawing.*—Geometrical drawing; free-hand and model drawing; mechanical-drawing; estimating	400
IV.	*Surveying.*—Surveying with chain, compass and plane table; levelling; theodolite surveying; topographical drawing	350
V.	*Language.*—Tamil or Telugu*	180
VI.	*Drills and Exercises.*—Physical fitness, gymnastics, &c.	100
	Final Total ..	2,000

Of the total marks, 1,600 shall be awarded by the Board of Examiners for examination work, and 400 by the College Staff for drawings, notes, field-work, work in the workshops, &c., executed during the course. The Board, however, shall call for and inspect such drawings, notes, &c., before finally accepting the marks given by the staff.

Term examinations will be held at the end of the first and third half-years of study, at which portions of the above subjects will be finally disposed of by the Board of Examiners. The marks awardable at these examinations are included in the final total.

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* Tamil to be obligatory for natives whose mother tongue is Telugu, and *vice versâ*. The choice of one of these two languages to be open to all other students.

Candidates must obtain one-third of the total marks in each of the subject heads I, II, III and IV, one-fourth in each of the subject heads V and VI, and one-half of the final total marks. They shall be arranged in two classes in order of merit; the first containing those who have obtained at least three-fourths of the total marks.

(*b*) PRACTICAL COURSE.—The practical course will comprise one year of practical study in workshops, or one year on large engineering works, on which instruction will be afforded similar to that given to the Civil Engineer pupils.

N.B.—During the workshop year, there will be a short course in riding. The charge to be met by each student will be about Rs. 30.

(3) DRAUGHTSMAN CLASS.

The course, which extends over two years, will embrace the following subjects, which carry the marks enumerated against each below:—

		Marks.
(1)	Practical and descriptive geometry	100
(2)	Free-hand, perspective and model drawing ..	120
(3)	Building drawing..	270
(4)	Machine drawing	200
(5)	Estimating	180
(6)	Topographical drawing	80
(7)	Drills and Exercises	50
	Total ..	1,000

Of the total marks, 600 shall be awarded by the Board of Examiners for examination work, and 400 by the College Staff for plans, &c., executed during the course. The Board, however, shall call for and inspect such drawings, &c., before finally accepting the marks given by the Staff.

A term examination will be held at the end of the first year.

Candidates obtaining 66 per cent. in each of the first five subjects and 75 per cent. on the total shall receive *First-class* Certificates: those obtaining 50 and 66 per cent., respectively, *Second-class* Certificates: those obtaining 36 and 50 per cent., respectively, *Third-class* Certificates.

(4) SURVEYOR CLASS.

The course, which extends over two years, will embrace the following subjects, which carry the marks enumerated against each below:—

		Marks.
(1)	Surveying with chain, compass and plane table ..	255
(2)	Levelling	215
(3)	Theodolite surveying	200
(4)	Topographical drawing	280
(5)	Drills and Exercises	50
	Total ..	1,000

Of the total marks, 600 shall be awarded by the Board of Examiners for examination work, and 400 by the College Staff for field-work and drawings executed during the course. The Board, however, shall call for and inspect such drawings, notes, &c., before finally accepting the marks given by the Staff.

A term examination will be held at the end of the first year

Candidates obtaining 66 per cent. in each of the first four subjects and 75 per cent. on the total shall receive *First-class* Certificates: those obtaining 50 and 66 per cent., respectively, *Second-class* Certificates: those obtaining 36 and 50 per cent., respectively, *Third-class* Certificates.

(5) MAISTRY AND ARTISAN CLASS.

The course of study shall be—

Arithmetic.	Scales.
Elementary Geometry.	Plan drawing.
Mensuration.	Elements of Engineering.

No examinations will be held, but a certificate of attendance shall be given by the Principal after a minimum period of one year's regular study. Students will be encouraged to appear for the elementary examination under the Science and Arts notification in subjects included in the above list. The instruction shall be given in the Tamil and Telugu languages, and the class shall be an evening one.

ARTICLE VI.—FEES.

(*a*) *Civil and Mechanical Engineer classes.*—The fee is fixed at Rs. 68 for each term of six months, payable in advance; or, if candidates so desire, they will be permitted to pay instead a monthly contribution of Rs. 12, but in either case a deposit of Rs. 100 will be demanded at the outset.

A student may compound for the whole theoretical course by the payment of a fee of Rs. 350 in advance. No fee will be demanded for the practical course, except in the case of Mechanical Engineer Students at the Madras Railway Company's Locomotive shops at Perambúr.

(*b*) *Engineer Subordinate Class.*—The fee is fixed at Rs. 30 for each term of six months, payable in advance; or a monthly contribution of Rs. 6, or Rs. 125 for the whole theoretical course, payable in advance. In every case a deposit of Rs. 75 will be demanded at the outset. No fee will be demanded for the Practical course.

Soldier students will be exempted from payment of College fees, and will be supplied with the text-books in use and with drawing instruments, colours, &c., gratis.

(*c*) *Draughtsman and Surveyor Classes.*—A term fee of Rs. 18 to be paid in advance, or a monthly contribution of Rs. 4. A deposit of Rs. 50 will be demanded from each student at the outset.

(*d*) *Maistry and Artisan Class.*—A term fee of Rs. 5, to be paid in advance, or a monthly contribution of Re. 1.

NOTE.—Fees will, under no circumstances, be returned after a student has been admitted to the institution.

ARTICLE VII.—CERTIFICATES.

(*a*) The Board of Examiners shall issue, under their signatures, a certificate to each candidate setting forth the class of study in which he has qualified; but, in the case of students of the Engineer and Engineer Subordinate classes, the final certificate, in the nature of a diploma, shall be issued under the signatures of the Principal of the College and of the Director of Public Instruction, in proof that the student concerned has satisfactorily completed the prescribed practical course.

College students appearing for the final examination at the end of their courses must pay before the commencement of the examination the undermentioned fees:—

	RS.
Engineer Class	20
Engineer Subordinate Class	15
Draughtsman Class	10
Surveyor Class	10

(*b*) A candidate who has failed to obtain a certificate from the Board at the final examination may appear before the Board for examination at any subsequent year, provided he is certified to have put in the necessary attendance at the College, and pays a fee as follows:—

	RS.
Civil and Mechanical Engineers	30
Engineer Subordinates	20
Draughtsman	10
Surveyors	10

A candidate who succeeds in qualifying in this way will receive a certificate setting forth the class of study to which he has attained, but he will not be eligible for the final certificate until he has satisfactorily completed the prescribed practical course. A Draughtsman or Surveyor who has obtained a certificate in the second or third class may also appear for examination in a subsequent year on payment of the fee prescribed above, with the view of qualifying for a certificate in a higher class.

(*c*) The names of the candidates passing as described in paragraph (*b*) will be published in the *Fort St. George Gazette* in a separate list.

ARTICLE VIII.—SCHOLARSHIPS, &c.

The following scholarships and prizes are allowed for students during their College course:

(1) *Engineer Classes.*—Three scholarships of Rs. 15 per mensem will be awarded annually to the three candidates standing highest in the entrance examination list who are admitted to the College. The scholarships are re-awardable annually on the results of each term examination.

A gold medal will be awarded to the student who passes first in the final examination.

(2) *Engineer Subordinate Class.*—Two scholarships, each of Rs. 12-8-0 per mensem, will be awarded annually to the two candidates

who pass highest on the list at the first term examination. The scholarships are re-awardable after the second term examination.

A silver medal will be awarded to the student who passes first in the final examination.

The "Walker" scholarship of the value of about Rs. 13 per mensem is tenable for three years and-a-half by a student of this class, being a native of a West Coast district including the Nilgiris, who, on entering the College, passes a colloquial examination in Canarese or Malayalam.

The "Rogers" prize of the value of about Rs. 20 will be given annually in books to the most distinguished student of this class after the final examination.

(3) *Draughtsmen Class.*—Two scholarships, each of Rs. 8 per mensem, tenable during the second year of study, will be granted to the students who stand highest on the list at the term examination at the end of the first year.

A bronze medal will be given to the student who passes first in the final examination.

(4) *Surveyor Class.*—Two scholarships, each of Rs. 8 per mensem, tenable during the second year of study, will be granted to the students who stand highest on the list at the term examination at the end of the first year.

A bronze medal will be given to the student who passes first in the final examination.

(5) Prizes consisting of instruments or books will be given in all the classes for special proficiency in particular subjects.

The "Sir Madhava Rau" prizes, three in number, of the value of Rs. 20 each, will be given annually, under certain prescribed conditions, for proficiency in practical work, such as workshops, surveying field work, laboratory work, &c. When practicable, one prize will be given to a Mahratta Brahmin.

NOTE.—Scholarships may be reduced or forfeited for misbehaviour or other cause.

ARTICLE IX.—PRACTICAL COURSES.

All allowances during the practical courses will be debitable to the Department of Public Works. Each year's course extends from 1st January to 31st December, and allowances admissible will be paid for the full period. During the first year of the practical course there will be a vacation extending from 1st May to 15th June.

(1) *Civil and Mechanical Engineers.*—During the final year of practical training, subsistence allowances of Rs. 50 per mensem for Europeans and Eurasians and Rs. 25 per mensem for Natives will be granted. Such allowances will, however, be contingent on the good conduct and satisfactory progress of the student under instruction; and on proof of misconduct or idleness the allowances may be cut down or withdrawn altogether by the officers in charge of the works. Travelling allowances to students joining and on the works will be drawn at the rates sanctioned for officers of the "third" class under the Civil Service Regulations.

One Mechanical Engineer student will be permitted each year to join the Madras Railway Locomotive shops at Perambur, the concession being offered in the order of merit at the final examination The premium for the course of two years will be Rs. 500, of which half will be defrayed by the Educational Department, the other half being met by the student Other Mechanical Engineer students will be trained in the Public Works Workshops *gratis*, or at Perambur on payment by them of the full premium.

(2) *Engineer Subordinates.*—As in the case of the Civil and Mechanical Engineer pupils, no fee will be exacted during the workshop year; and during the year of practical study on works stipends will be granted of Rs. 30 per mensem for Europeans and Eurasians and Rs. 20 per mensem for Natives, subject to the conditions of good conduct, regular attendance, &c. Travelling allowances to students joining and on the works will be drawn at the rates sanctioned for officers of the "third" class under the Civil Service Regulations.

Soldier students will, during the workshop course, draw pay, rations and clothing from their regiments, and the stipends prescribed for the theoretical course. During their year of practical training on works, they will cease to draw those allowances, and will be brought on to the Public Works Department scale of establishment as apprentice overseers, drawing the pay and allowances laid down in the Public Works Regulations.

Students who obtain their certificates under Article VII, clause (*b*), shall be entitled to receive practical instruction as Civil or Mechanical Engineers or as Engineer Subordinates, respectively, on works being carried out by the Public Works Department, subject to such orders as may be passed by the Chief Engineer, and clause (3) of Article XI shall apply to such students whilst so engaged.

ARTICLE X.—PROSPECTS OF STUDENTS.

(1) *Civil and Mechanical Engineers.*—One appointment as apprentice Engineer in the Provincial service of the Public Works Department will be offered to the student in each batch who stands highest on the list at the final Examination, and who has also obtained the degree in Engineering of the Madras University.

(2) *Civil and Mechanical Engineers and Engineer Subordinates.*—Vacancies in the Overseer Grades of the Public Works Department will, as a rule, be filled by fully qualified men from the Civil and Mechanical Engineer or Engineer Subordinate Classes, but, in the case of non-Military students, no such appointment will be made to any grade of the Subordinate establishment higher than that of Overseer of the Third Grade, except under special and unusual circumstances. Notice will be given about six months before the final examination at the College of the number of such appointments likely to be available.

NOTE—*The following appointments in the Public Works Department in the Third Grade of Overseers have been guaranteed to the Engineer Subordinate Class:—*

5 in January 1896. 5 in January 1897

(3) *Draughtsman.*—Certificated students of this class will be appointed to the Public Works Department as Draughtsmen and Estimators as vacancies occur. The course of instruction having been extended and the standard for certificate having been raised, passed students under these rules will be entitled to the improved salaries for the different classes of Draughtsmen which will be notified hereafter.

(4) *Surveyors.*—There are no permanent appointments available in the Public Works Establishment for Surveyors only; but, when the services of temporary men are required for special surveys not undertaken by the Public Works subordinate staff, the officers in charge are instructed to select for such employment none but passed Surveyors of the College of Engineering.

Qualified men may be appointed Probationary Deputy Surveyors, Madras Survey, on Rs. 50 with the prospect of rising eventually to the rank of Sub-Assistant Superintendent on Rs. 250.

NOTE.—It is the duty of the Principal to render all reasonable assistance to passed students who may not be appointed to the Public Works Department, in seeking employment under Local and Municipal Boards and other agencies. With this view, lists of qualified men, with remarks as to their attainments, conduct, &c , will be circulated annually to Local Fund Boards and Municipalities, with recommendations that they may be employed in suitable posts when opportunities offer.

ARTICLE XI.—GENERAL.

(1) Students in the Civil and Mechanical Engineer classes are expected to appear for the B.E. degree examination; but they are discouraged from appearing until they have completed the three years' theoretical course.

(2) All students must provide themselves with the text-books in use and with the necessary apparatus, instruments (except surveying instruments), &c. They will, with the exception of military students, be non-resident. Strict observance of the standing rules of the institution as regards attendance, discipline, &c., will be expected from all.

(3) Students during their practical course shall not be under the supervision of the Principal of the College, but officers under whom they are serving will be required in the Public Works Department to furnish to the Principal half-yearly reports of their progress in such form as may from time to time be prescribed by Government.

II.—RULES OF ADMISSION.

(1) Engineer Classes.

A Competitive Examination for admission to the Engineer classes will be held annually on the first Monday in December, commencing at 10 A.M., at the College of Engineering, Madras, and at Rajahmundry, Bellary, Calicut, and Madura. Candidates who have passed the F.A. Examination of the Madras or other Indian University, who will be between 17 and 21 years of age on 31st December following, and who have complied with the conditions laid down in paragraph 3 below, will alone be eligible to compete. The first 15 qualified candidates on the list will be selected for admission, provided that, if 4 Europeans or Eurasians and 3 Muhammadans be not within the first 15, the number under each may be made good in order of merit from the other qualified candidates belonging to these classes.

(2) The Scheme of Examination will be as follows:—

		Marks.
Morning paper 10 A.M. to 1 P.M.	Arithmetic	100
	Algebra	75
	Mensuration	50
Afternoon papers 2 P.M. to 3 P.M.	English Composition	80
	Hand-writing	60
3 P.M to 5 P.M.	Geometry	75
	Plane Trigonometry	100
	Total ..	540

Qualifying minimum—216 marks.

(3) Application for admission to this examination will be received by the Principal up to the first Monday in November. Each application must be accompanied by—

(*a*) a receipt showing that the necessary fee, Rs. 20, has been paid into a Government Treasury or the Bank of Madras. The fee will under no circumstances be refunded;

(*b*) *copies* of testimonials certifying to good character and conduct for a period of not less than two years, immediately prior to date of application;

(*c*) *copy* of horoscope or other certificate of birth;

(*d*) statement in the following form filled up in the candidate's hand-writing:—

Application for Admission to the Engineer Class, College of Engineering, Madras.

Candidate's name in *full*.	Candidate's address.	Name and address of father or guardian.	Date of birth.	Race and religion.	Year of passing F.A. Examination.	Register number and rank in F.A. Examination.	Whether passed B.A. Examination or appeared for it, or about to appear.	List of documents enclosed.	Place at which candidate desires to appear for Entrance Examination.

Place.

Date. *Signature of Candidate.*

The form will be drawn up by the candidate on a half sheet of foolscap paper.

(4) The names of the successful candidates will be published in the *Fort St. George Gazette.* The candidates will join the College on the last Monday in January (unless appearing for the B.A. Degree Examination, when they must present themselves on the first Monday in February), and must each on that day deposit with the Principal—

(*a*) the sum of Rs. 100, which will be drawn against for books, drawing instruments, &c., any balance being ultimately returned to the candidate;

(*b*) a certificate from a Gazetted Government Medical Officer declaring that the candidate is of good constitution, free from disease, fit for the out-door work of the Public Works Department, and that he has been vaccinated. The certificate must bear a personal description of the candidate;

(*c*) original University certificate;

(*d*) originals of certificates referred to in paragraph 3.

(2) Engineer Subordinate ("Overseer") Class.

(*a*) CIVIL CANDIDATES.

Admission to the Engineer Subordinate Class is open to persons who have passed the Upper Secondary Examination, or the First-in-Arts or Matriculation Examination of the Madras or other Indian University, whose ages were between 16 and 20 on the 31st December preceding the date fixed for admission, and who have complied with the conditions prescribed in paragraph 4 below.

Candidates who have passed the First Arts or Upper Secondary Examination will be admitted preferentially, and without examination.

Matriculates will be admitted by competitive examination to be held on the last Monday in April, commencing at 10 A.M. at the College of Engineering, Madras, and at Berhampore, Vizagapatam, Rajahmundry, Masulipatam, Bellary, Kurnool, Nellore, Kumbakónam, Madura, Calicut, Mangalore and Trivandrum.

(2) The Scheme of Examination will be as follows :—

		Marks.
Morning paper 10 A.M to 1 P.M.	Arithmetic	125
	Algebra	75
Afternoon papers 2 P.M. to 3-30 P.M	English Composition	80
	Hand-writing	60
3-30 P.M. to 5 P.M.	Geometry	100
	Total ..	440

Qualifying minimum—176 marks.

(3) The names of the candidates who pass the Entrance Examination will be arranged in order of merit on a list, below the names of applicants who have passed the First Arts or Upper Secondary Examination, and the first 25 candidates on the list will be selected for admission, provided that, if 6 Europeans and Eurasians and 4 Muhammadans be not within the first 25, the number under each may be made good in order of merit from the other qualified candidates belonging to these classes.

(4) Applications for admission will be received by the Principal up to the first Monday in April. Each application must be accompanied by—

(*a*) a receipt showing that the necessary fee, Rs. 15, has been paid into a Government Treasury or the Bank of Madras. The fee will under no circumstances be refunded;

(*b*) *copies* of testimonials certifying to good character and conduct for a period of not less than two years immediately prior to date of application;

(*c*) *copy* of horoscope or other certificate of birth;

(*d*) a statement in the following form filled up in the candidate's hand-writing:—

Application for Admission to the Engineer Subordinate class, College of Engineering, Madras.

Candidate's name *in full.*	Candidate's address.	Name and address of father or guardian.	Date of birth.	Race and religion.	Examination passed, viz., First Arts, Upper Secondary or Matriculation.	Year of passing examination and register number and rank.	List of documents enclosed.	Place at which candidate desires to appear for Entrance Examination.

Place.

Date. *Signature of Candidate.*

The form will be drawn up by the candidate on a half sheet of foolscap paper. The last column will be filled in by Matriculates only.

(5) The names of the successful candidates will be published in the *Fort St. George Gazette*. The candidates will join the College on the first Monday in July, and must on that day deposit with the Principal—

(*a*) the sum of Rs. 75, which will be drawn against for books, drawing instruments, &c., any balance being ultimately returned to the candidate ;

(*b*) a certificate from a Gazetted Government Medical Officer declaring that the candidate is of good constitution, free from disease, fit for the out-door work for the Public Works Department, and that he has been vaccinated. The certificate must bear a personal description of the candidate ;

(*c*) original University or Upper Secondary certificate ;

(*d*) originals of certificates referred to in paragraph 4.

(*b*) MILITARY CANDIDATES.

A Competitive Examination for admission to the College of Engineering, Madras, will be held annually on the last Monday in November. The examination will be conducted by means of papers forwarded from the College to Officers Commanding Regiments and Batteries, who are requested to detail one or more officers to superintend the examination in accordance with rules which will be furnished with the papers. Candidates from Madras, St. Thomas' Mount and Poonamallee will be examined at the College.

(2) Candidates must—

(*a*) be non-commissioned officers or men of Her Majesty's British Forces of not less than two years' service, and under twenty-five years of age;

(*b*) have uniformly conducted themselves to the satisfaction of their Commanding Officers in the discharge of their duties;

(*c*) be thoroughly trustworthy and well-conducted men, who can be relied on to superintend native workmen and to treat them in a becoming manner.

(3) Applications from Commanding Officers for the examination of such men as they may recommend for admission should reach the Principal not later than 15th October, and should be accompanied by the following documents, viz.:—

(*a*) Extract from Troop and Company or Battery Defaulter Sheet.

(*b*) Extract from third page of Attestation.

(*c*) Do. from Court-martial Sheet.

(*d*) Certificate of sound health and unimpaired constitution from a Commissioned Medical Officer.

Each application should state whether the candidate is married.

(4) The entrance examination, which occupies one day, comprises the following subjects:—

	Marks.
Arithmetic—The whole subject; one three-hour paper.	100
English Dictation	50
English Grammar and Composition—Grammatical rules, construction of sentences, short essay; one two-hour paper	50
Total ..	200

Qualifying minimum—100 marks.

(5) The first five qualified candidates will be admitted, and will join the College on last Monday in January. They will undergo in the following December an examination in Arithmetic, Algebra, Geometry and Vernacular Language, and those who are successful will be admitted to the Engineer Subordinate Class for the regular course of technical study.

NOTE.—Soldier students will be under the command of the Principal, or, in his absence, of the officer acting for him. They will reside in barracks and quarters attached to the College, and will wear the undress uniform of their regiments. They are exempt from payment of College fees, and are supplied with the text-books in use, and with drawing instruments, colours, &c., gratis.

(3) Draftsman Class.

A Competitive Examination for admission to the Draftsman class will be held annually on the first Monday in December, commencing at 10 A.M., at the College of Engineering, Madras, and at Berhampore, Vizagapatam, Rajahmundry, Masulipatam, Bellary, Kurnool, Nellore, Kumbakónam, Madura, Calicut, Mangalore and Trivandrum. Candidates who have passed the Lower Secondary, late Middle School, or other higher examination, who will be between 16 and 22 years of age on 31st December following, and who have complied with the conditions laid down in paragraph 3 below, will alone be eligible to compete. The first 35 qualified candidates on the list will be selected for admission, provided that, if 4 Europeans or Eurasians and 3 Muhammadans be not within the first 35, the number under each may be made good in order of merit from the other qualified candidates belonging to these classes.

(2) The Scheme of Examination will be as follows :—

		Marks.
Morning papers		
10 A.M. to 12 A.M.	Arithmetic (to the end of fractions)	70
12 A.M. to 1 P.M.	English Composition	70
	Hand-writing (to be judged from the manner in which the English Composition is written) ..	60
Afternoon paper 2 P.M. to 5 P.M.	Drawing (copy of a lithographed drawing)	70
	Total ..	270

Qualifying minimum—108 marks.

(3) Application for admission to this examinaton will be received by the Principal up to the first Monday in November. Each application must be accompanied by—

(*a*) a receipt showing that the necessary fee, Rs. 5, has been paid into a Government Treasury or the Bank of Madras. The fee will under no circumstances be refunded;

(*b*) *copies* of testimonials certifying to good character and conduct for a period of not less than two years, immediately prior to date of application;

(*c*) statement in the following form filled up in the candidate's hand-writing :—

Application for admission to the Draftsman Class, College of Engineering, Madras.

Candidate's name *in full.*	Candidate's address.	Name and address of father or guardian.	Date of birth.	Race and Religion.	Year of passing Lower Secondary or late Middle School Examination.	Register number and rank in examination.	Whether passed Matriculation or higher Examination; if so, date and register number.	List of documents enclosed.	Place at which candidate desires to appear for Entrance Examination.

Place.
Date.

Signature of Candidate.

The form will be drawn up by the candidate on a half sheet of foolscap paper.

(4) The names of the successful candidates will be published in the *Fort St. George Gazette*. The candidates will join the College on the last Monday in January and must each on that day deposit with the Principal—

(*a*) the sum of Rs. 50, which will be drawn against for books, drawing instruments, &c., any balance being ultimately returned to the candidate ;

(*b*) a certificate from a Government Medical Officer declaring that the candidate is of good constitution, and free from disease, that he has been vaccinated, and that his age lies between 16 and 22 years. The certificate must bear a personal description of the candidate ;

(*c*) original Lower Secondary, late Middle School or Matriculation, &c., certificate ;

(*d*) originals of certificates referred to in paragraph 3 ;

(*e*) a leaving certificate from the head of the school in which the candidate last studied.

(4) Surveyor Class.

A Competitive Examination for admission to the Surveyor class will be held annually on the first Monday in December, commencing at 10 A.M., at the College of Engineering, Madras, and at Berhampore, Vizagapatam, Rajahmundry, Masulipatam, Bellary, Kurnool, Nellore, Kumbakónam, Madura, Calicut, Mangalore and Trivandrum. Candidates who have passed the Lower Secondary, late Middle School, or other higher examination, who will be between 16 and 22 years of age on 31st December following, and who have complied with the conditions laid down in paragraph 3 below, will alone be eligible to compete. The first 25 qualified candidates on the list will be selected for admission, provided that, if 4 Europeans or Eurasians and 3 Muhammadans be not within the first 25, the number under each may be made good in order of merit from the other qualified candidates belonging to these classes.

(2) The Scheme of Examination will be as follows :—

		Marks.
Morning papers		
10 A.M. to 12 A.M.	Arithmetic (to the end of fractions)	70
12 A.M. to 1 P.M.	English Composition	70
	Hand-writting (to be judged from the manner in which the English Composition is written).	60
Afternoon paper		
2 P.M. to 5 P.M.	**Drawing** (copy of a lithographed drawing)	70
	Total ..	270

Qualifying minimum—108 marks.

(3) Application for admission to this examination will be received by the Principal up to the first Monday in November. Each application must be accompanied by—

(*a*) a receipt showing that the necessary fee, Rs. 5, has been paid into a Government Treasury or the Bank of Madras. The fee will under no circumstances be refunded ;

(*b*) *copies* of testimonials certifying to good character and conduct for a period of not less than two years, immediately prior to date of application ;

(*c*) statement in the following form filled up in the candidate's hand-writing :—

Application for Admission to the Surveyor Class, College of Engineering, Madras.

Candidate's name *in full*.	Candidate's address.	Name and address of father or guardian.	Date of birth.	Race and religion.	Year of passing Lower Secondary or late Middle School Examination.	Register number and rank in examination.	Whether passed Matriculation or higher examination; if so, date and register number.	List of documents enclosed.	Place at which candidate desires to appear for Entrance Examination.

Place.

Date. *Signature of Candidate.*

The form will be drawn up by the candidate on a half sheet of foolscap paper.

(4) The names of the successful candidates will be published in the *Fort St. George Gazette*. The candidates will join the College on the last Monday in January and must each on that day deposit with the Principal—

(*a*) the sum of Rs. 50, which will be drawn against for books, drawing instruments, &c., any balance being ultimately returned to the candidate ;

(*b*) a certificate from a Government Medical Officer declaring that the candidate is of good constitution, free from disease, fit for the out-door work of the Public Works Department, that he has been vaccinated, and that his age lies between 16 and 22 years. The certificate must bear a personal description of the candidate ;

(*c*) original Lower Secondary, late Middle School or Matriculation, &c., certificate ;

(*d*) originals of certificates referred to in paragraph 3 ;

(*e*) a leaving certificate from the head of the school in which the candidate last studied.

(5) Maistry and Artisan Class.

The names of candidates will, provided the conditions laid down in paragraph 2 are complied with, be received by the Principal for registration up to the first Monday in November. The registered names will be placed on a list from which 30 candidates will be selected for admission in the following January to the College of Engineering. Selection will be made, as far as possible, from the sons of artisans or maistries, or from youths who have already had practical training in some of the building trades.

(2) Applications will be registered on receipt of—

(*a*) a registration fee of eight annas, by money order or in cash or postage stamps, not to be returned if the application is not accepted, but to be given credit for an admission of candidate, the admitted candidate paying a term fee of five rupees in advance or a monthly fee of one rupee;

(*b*) *copies* of testimonials certifying to the occupation of the candidate, if any, and that of his father, as well as to the candidate's good character for a period of not less than two years immediately prior to the date of application;

(*c*) statement in the following form :—

Application for Admission to the Maistry and Artisan Class, College of Engineering, Madras.

Name *in full*.	Address.	Age.	Race and Religion.	Occupation of candidate, if any.	Occupation of father.	List of documents enclosed.

Place.

Date. *Signature of Candidate.*

The form will be drawn up by the candidate on a half sheet of foolscap paper.

(3) The selected candidates will join the College on the last Monday in January, and must each on that day deposit with the Principal—

(*a*) a certificate from a Government Medical Officer that he is free from disease, that his age lies between 16 and 22 years, and that he has been vaccinated;

(*b*) original certificates referred to in paragraph 2.

J. P. DAVIDSON,
Ag. Principal, College of Engineering.

SYLLABUSES.

ENGINEER CLASSES.

I.—PURE MATHEMATICS. MARKS, 475.

A.—ALGEBRA.

Representation of unknown quantities. The signs plus and minus. The use of brackets. Numerical evaluation of algebraic expressions. Addition. Subtraction. Multiplication. Division. Highest common factor, and lowest common multiple of two or more expressions. Fractions. Involution and evolution. Indices. Simple equations. Quadratic equations. Simultaneous equations. Permutations and combinations. Binomial theorem. Use of logarithms. Interest and discount. Indeterminate co-efficients. Roots and co-efficients of equations. Partial fractions. Summation of series. Approximate solution of equations by Horner's method.

B.—GEOMETRY.

(1) **Euclid.**—Books I—IV, VI and XI up to Proposition 21, with definitions of Book V; also easy deductions.

(2) **Geometrical Conic Sections.**—The chief properties of the parabola, ellipse and hyperbola.

C.—ARITHMETIC.

The whole subject.

D.—MENSURATION.

Plane and solid.

E.—TRIGONOMETRY.*

Angular measurement, degrees and radians. Use of signs in denoting direction. Trigonometrical functions. Formulæ including angles which have the same sine, cosine or tangent. Trigonometrical functions of the sum or difference of two angles, with special cases. Practical use of logarithms. Solution of triangles. Adaptation of formulæ to logarithmic calculation. Heights and distances.

F.—ALGEBRAIC GEOMETRY.†

Definition of co-ordinates. Determination of a point. Representation of a locus by means of an algebraic equation. Equation of a straight line. Systems of straight lines. Conditions of parallelism and perpendicularity. Angle between two straight lines. Areas of triangles and rectilinear figures. The circle, various forms of its equation and of the equations of chord and tangent. The parabola, its equation referred to its axis and the tangent at the vertex as co-ordinate axes. Equations of chord, tangent, and normal in various forms. The ellipse, various forms of its equation. The eccentric angle. Equations of chord, tangent and normal. Equation of the hyperbola.

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* Special attention will be paid to the practical solution of triangles required in surveying.

† Rectangular co-ordinates only.

G.—DIFFERENTIAL AND INTEGRAL CALCULUS.

(1) **Differential Calculus.**—Definition of function of a variable. Differentials. Differential co-efficients. Rates. Velocity and acceleration. Differentiation of sum, difference, product and quotient. Successive differentiation. Leibnitz's theorem. Differentiation of algebraic, circular and logarithmic functions. Maxima and minima. Theorems of Tailor and Maclaurin. Curves. Equation of tangent and normal. Curvature. Singular points. Curve tracing.

(2) **Integral Calculus.**—Definition of integral. Integration of simple functions. Integration of algebraic functions by resolution into partial fractions. Integration by substitution. Integration by parts. Formulæ of reduction. Definite integrals. Rectification of curves. Calculation of areas and volumes. The planimeter. Calculation of moments of inertia. The integrator. Determination of mass centres and centres of pressure.

II.—SCIENCE. MARKS, 525.

A.—PHYSICS.*

(1) **Kinematics.**—Uniplanar displacement. Translation and rotation. The instantaneous centre. Motion, relative and absolute. Velocity and acceleration, and formulæ connected with them. Parallelograms of velocities and accelerations. Angular velocity. Uniform motion in a circle. Simple harmonic motion.

(2) **Dynamics.**—Mass, density and momentum. Newton's Laws of Motion.

(*a*) *Statics.*—Definition and measurement of force. Parallelogram of forces. Triangle and polygon of forces. Composition and resolution of forces in one plane. Parallel forces. Couples. Theory of moments. Conditions of equilibrium of a system of uniplanar forces. Mass centres. Reaction at joints. Tension of strings. Elastic strings. Laws of friction. Machines with and without friction. The principle of virtual work and its application to machines. Efficiency of machines.

(*b*) *Kinetics.*—Equations of motion deduced from Newton's second Law. Conservation of momentum. Definition and measurement of work and energy, potential and kinetic. Gravity. Attwood's machine. Projectiles. Constrained motion. The simple pendulum. Moment of inertia and radius of gyration. D'Alembert's principle. Impact and impulsive tensions. Centre of percussion. Ballistic pendulum.

(3) **The Theory of Elasticity.**—Elasticity. The elastic limit. Stress and strain. Hooke's law. Modulus of Elasticity. Elasticity of Volume. Oersted's piezometer.

(4) **Hydrostatics.**—Fluids. The transmission of fluid pressure. Pressure of a fluid on a plane area. Centre of pressure. Pressure of a fluid

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* The course in mechanics will be taught with the aid of experimental apparatus, and will have a special bearing on engineering problems. Instruction in hydrostatics will be given with the aid of apparatus, and students will be exercised in the practical determination of specific gravities.

on bodies wholly or partially immersed. Principle of Archimedes. Conditions of equilibrium of floating bodies. Metacentre. Density. Specific Gravity. Determination of specific gravities of solids by means of Specific gravity balance, Nicholson's hydrometer, and Specific gravity bottle. Specific gravity of liquids. Hydrometers of variable immersion. The general phenomena of capillary elevation and depression.

Machines for raising Water—The principles underlying the action of the Suction Pump, Force Pump, Centrifugal Pump, and Jet Pump. The Hydraulic Press. The Siphon.

(5) **Pneumatics.**—Expansibility of gases. Weight of air. Torricelli's experiment. The cistern aneroid barometers Laws of Boyle and Charles. Regnault's experiments. Pressure gauges. The Air Pump. Balloons.

(6) **Heat.**—Distinction between Heat and Temperature. Methods of measuring Temperature. Thermometric Scales. Construction and graduation of the Mercurial Thermometer. Construction and principles underlying the action of other Thermometers.

Physical effects of Heat. Dilatation. Linear and cubical expansion of solids. Expansion of liquid and gases. Effects of expansion. The compensated pendulum.

Change of State:—1, From solid to liquid. 2, From liquid to gaseous. Latent heat. Freezing mixtures. Behaviour of water when heated. Ebullition Vaporization and condensation. Effect of pressure on the boiling point. Vapour pressure. Saturation. Cold produced by evaporation. Mixture of gases and vapours. Condensation of aqueous vapour. The dew point. Hygrometry. Clouds, rain, hail and snow. Specific heat. Calorimetry.

Convection of heat in liquids and gases Ventilation and warming of buildings by air currents. Chimney draught.

Conduction of Heat Reflection, Radiation and Absorption of Heat.

Principle of the Conservation of Energy. Convertibility of heat into work and *vice versâ*. Joule's experiments.

Laws of Thermodynamics.

Sources of heat. Solar radiation. Internal heat of the earth. Fuels.

B.—CHEMISTRY.

(1) **Preliminary.**—Elementary and compound substances. Solids, liquids and gases. Metals and non-metals. Illustrations of Chemical action. Laws of Chemical combination. Dalton's Atomic theory. Principles of chemical nomenclature. Symbolic notation, formulæ and equations. Calculation of the weights of substances involved in chemical reactions.

(2) **Air.**—A simple chemical investigation of the composition of air. Proof synthetical and analytical that it is a mechanical mixture consisting chiefly of the two elementary gases, Oxygen and Nitrogen. Chief properties of these two elements and methods by which they may be prepared.

(3) **Water.**—A similar investigation of the composition of water, demonstrating that it is a chemical compound formed by the union of the two elementary gases, Oxygen and Hydrogen. Preparation and properties of Hydrogen.

(4) **Chlorine,** Bromine and Iodine. Their sources, preparation, and properties. Hydrochloric Acid.

(5) **Sulphur.**—Its properties, occurrence in nature, and allotropic modifications. Preparation and properties of Sulphuretted Hydrogen. The acid-forming oxides of Sulphur and their oxy-acids Sulphuric Acid.

(6) **Nitrogen.**—Preparation and properties of Ammonia. Compounds of Nitrogen and Oxygen. Nitric Acid.

(7) **Carbon.**—Its occurrence in nature, allotropic forms, and their principal properties. Coal. The two oxides of carbon. Carbonates.

(8) **Water.**—Permanent and temporary hardness. Processes for obtaining soft water. The most common impurities of water, their sources, and simple methods of detecting them. Filters. Sources of water. Sources of contamination. Simple methods of determining the suitability of water for drinking purposes. Filters. Hard and soft water. Soft and temporary hardness. Processes for softening water.

(9) **Application of Chemistry to Engineering** as shown by its value in determining the composition of Fuels, Oils, Limestones, Chalks, Clays and Cements.

As far as possible, students will receive practical instruction in the maipulation and preparation of simple forms of chemical apparatus. Practical Instruction in Qualitative and Quantitative Analysis will form part of this course.

C.—GEOLOGY.

(1) **Introductory Remarks.**—Definition of Geology. Changes taking place on the surface of the earth. Denudation of land by atmospheric action, wind, rain, frost and snow; by the sea, action of tides and waves. Deposition of strata in seas, lakes and estuaries. Vegetable and Animal life as geologic agents in modifying the physical features of the earths' surface

The composition and structure of the earths' surface.

(2) **Rocks.**—1, Igneous. 2, Metamorphic. 3, Sedimentary. Their composition and chief characteristics. Their value for Engineering purposes.

Metamorphism of sedimentary strata under the great pressure and temperature existing beneath the surface of the earth.

Stratification of Rocks. Outcrop, Dip, Strike. Anticlinal and Synclinal Curves. Faults, Lodes, Veins and Dykes.

Structure of Rocks. Lamination, Cleavage and Foliation. Snow and Ice. Glaciers and Icebergs. Erosion and transport of matter.

(3) **Rivers.**—Sources of Rivers, Lakes and Springs. Formation of Valleys, Terraces, Deltas and Bars. Transport of material from the high lands to the low.

(4) **The Sea.**—Marine denudation. Formation of sand dunes and shingle beaches. Bays and headlands. Distribution of sediment from rivers forming modern marine strata. Preservation of Fossils. Internal heat of the earth. Volcanic action. Distribution of volcanoes. Earthquakes.

III.—ENGINEERING. MARKS, 775.

A.—BUILDING MATERIALS.*

(1) **Stone.**—Varieties met with in Southern India. Quarrying. Blasting with powder and dynamite. Dressing. Average strength and weight of stone.

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* During this course, visits of inspection will be made to the following and other works :—

(a) Pallávaram stone quarries.
(b) Perambúr brickfields.
(c) Government brickfield, Poonamallee Road.
(d) Lime-kilns, Cochrane's Basin.
(e) Madras cement works.
(f) Gun Carriage Factory, or other foundry.

Written reports are not required, but students will submit note books of dimensioned sketches illustrative of the processes witnessed.

(2) **Bricks and Tiles.**—Brick earth. Tempering. Hand and Machine Moulding. Drying. Burning in clamps and kilns. Hoffman's kiln. Coloured bricks and tiles. Pressed Bricks. Roofing, flooring and drain tiles. Fire bricks. Average strength and weight of brick. Characteristics of good bricks and tiles.

(3) **Lime, Cement, Mortar, Concrete, Plaster.**—Sources and properties of lime. Burning in intermittent and running kilns. Slaking. Mortar mixing. Fat and Hydraulic limes. Portland cement manufactured in England and in Madras. Hydraulic mortar. Surki. Concrete. Practical tests for limes and cements. Strength of mortars and concretes. Plaster and plastering. Pointing. White and colour washing.

(4) **Timber.**—Growth. Felling. Seasoning, natural and artificial. Conversion. Preservation of timber. Varieties of timber used in Southern India—teak, saul crool, karimaridoo, padowk, vengay, benteak, aynee, red and white cedar, rose-wood, casuarina, mango, palmyra, cocoanut, bamboo. Characteristics of strength and weight of timber. Characteristics of good timber.

(5) **Metals.**—Iron ores. Smelting. Grey and white pig iron. Castings. Pipes and columns of cast iron. Chilled castings. Strength of cast iron. Brief description of the manufacture of wrought iron. Forms of wrought iron. Galvanized and corrugated iron. Tests and strength of wrought iron. Rivets and bolts. Punching and drilling holes. Riveting. Cutting plates and bars. Welding. Steel, hard and mild. The Bessemer process. Strength of steel. Copper. Zinc. Lead. Tin. Alloys. Soldering metals.

(6) **Paints and Varnishes.**—Ingredients of paint. Litharge. Turpentine. Linseed oil. Mixing paint. Painting old and new work. Wood oil. Coal tar. Distemper. Varnish. Papering. Putty. Glazing.

B.—BUILDING CONSTRUCTION.*

(1) **Masonry.**—Coursed and uncoursed rubble. Block in courses. Ashlar. String courses. Copings. Bricklaying English and Flemish bond. Bond at angles of walls, in footings with offsets, between main and cross walls, at door and window openings and in circular pillars. Foundations and footings. Plinth. Damp roof course. Thickness of main and cross walls. Wall plates. Wood bricks and plugs. Openings for timber beams, for doors and windows. Corbelling. Flat, segmental, pointed and relieving brick arches. Inverts. Centres for small arches. Bond in brick and stone arches. Small oblique arches. Enclosure walls. Buttresses and counterforts. Retaining and breast walls. Scaffolding.

(2) **Foundations.**—Excavation. Masonry and concrete foundations. Unequal settlement. Pressure on soil under foundations. Foundations on rock, good and bad soils. Piles. Coffer dams and caissons. Well foundations. Brick and iron wells. Mode of sinking wells. Patent excavators for well sinking. Setting out buildings from working plans.

(3) **Carpentry.**—Mortise and tenon joint. Fishing and scarfing. Iron straps and bolts. Roof frames, nature of stress in the different members. Detail of joints. Frames of timber and iron combined. Trussed beams.

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* Great stress will be laid on the importance of making large size detail sketches, completely dimensioned. Visits of inspection will be made to buildings in progress, and note books of sketches will be submitted. Buildings will be set out on the ground.

In connection with this subject, Building drawings will be executed as part of the Drawing course—*vide V. Drawing.*

Timber floors. Stairs, designing and setting out. Doors and windows Centerings for arches. Striking centres.

(4) **Roofs and Floors.**—Terrace roofs and floors on joists, beams and joists, or iron girders and joists. Bengal terrace roofs. Fire-proof floors. Brick arched roofs. Pitched roofs. Couples. Trusses. Rafters, purlins and reepers. Roof coverings of thatch, tiles, slates and shingles. Ceilings. Floors of stone, brick, tiles, concrete, timber and asphalte. Simple forms of iron roofs. Use of tee, angle and channel iron in compression, and of rods and flat bars in tension. Joints and connections. Shoes, rivets, bolts. Iron and timber purlins. Brackets. Patent tiles, corrugated iron, lead and zinc roofing, Modes of attachment. Ventilators.

C.—BRIDGE CONSTRUCTION.*

(5) **Site, Waterway and Design for Bridges.**—Choice of site. Nature of stream or river. Nature of bed and banks. Purpose of bridge. Waterway. Estimation of velocity and discharge in maximum floods. Permissible velocity. Afflux. Choice of material—timber, stone, brick, cast iron, wrought iron and steel. Relative cost of large and small spans. Setting out. Square and skew bridges with straight and splayed wing-walls.

(6) **Temporary Bridges.**—Paved causeways. Spar bridges. Suspension bridges of rope, wire, chain, &c. Bridges of boats or pontoons. Width of roadway. Swing openings. Draw bridges. Temporary bridges for road or railway diversions with crib-work piers.

(7) **Masonry Bridges.**—Solid, well and pile foundations. Modes of putting in foundations. Flooring. Arches, segmental, elliptic and many-centred. Setting out such arches full size. Equilibrium of the arch. Approximate rules for thrust. Design and construction of piers and abutments. Skewbacks, cutwaters, wing-walls, thickness of arch ring. Centerings; principles and mode of construction. Setting out courses on centres. Construction of arch ring in stone or brick. Bond. Spandrils, Face walls. Blocking course and parapets. Roadway. Drainage. Striking centres. Approaches. Oblique arches; practical modes of laying out courses.

(8) **Timber Bridges.**—Abutments. Timber or masonry piers. Crib work. Frames of timber or timber and iron combined. Abutting frames Trapezoidal truss Lattice frames. Joints. Modes of erection. Roadway Arched ribs of planks.

(9) **Iron and Steel Bridges.**—Foundations, solid, masonry or iron wells. Piers, abutments and wing-walls. Forms of iron used. Bolts and rivets. Riveted joints. Punched and drilled holes. Chain and lozenge riveting. Mode of connecting plates when parallel and at right angles. Pin connections. Rolled beams. Iron piers. General arrangement of main and cross girders and superstructure for road and railway bridges. Principal forms of main girders; parallel or curved flanges with plate or open web. Detailed description of a plate girder bridge with parallel flanges. Detailed description of an open web girder bridge with one system of vertical and diagonal bracing. Other varieties of open web girders. Erection of girders. Allowance for expansion. Support of ends. Suspension bridges. Wrought iron arches.

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* Great stress will be laid on the importance of making large size detail sketches, completely dimensioned. Visits of inspection will be made to bridges in progress or completed, and note books of sketches will be submitted. Bridges will be set out on the ground. Arches will also be set out on a floor, and skewbacks and courses marked.

In connection with this subject, Bridge drawings will be executed as part of the Drawing course—*vide V. Drawing.*

D.—EARTHWORK, ROADMAKING AND RAILWAY CONSTRUCTION.*

(a) Earthwork.

(1) *Preliminary.*—Working plans and sections. Borings and trial pits. Stripping top soil. Equalizing cuttings and embankments. Spoil banks. Stability of earthwork. Side slopes. Computation of contents of earthwork. Prismoidal formula. Use of tables. Widths and areas of land required.

(2) *Setting out.*—Marking centre line. Formation level. Setting out cross sections on level and side lying ground.

(3) *Tools and Plant.*—Bevil plumb rule. Clinometer. Spirit level. Mason's level. Wheel and hand barrows, wagons, baskets, mamoties, pickaxes, shovels and spades. Crowbars, jumpers, and hand drills.

(4) *Embankments.*—Embankment formed from cuttings or side cuttings. Profiles. Punning. Repairs and additions. Puddle. Formation and repair of tank bunds.

(5) *Cuttings.*—Run to embankments or to spoil. Operations in opening out a cutting. Plank runs, steps and ramps.

(6) *Drainage.*—Dressing and turfing slopes. Stone pitching. Drainage of earthworks. Retaining walls.

(b) Roadmaking.

(1) *Classification, &c.*—Fair weather and permanent roads, direction, gradients. Cross section of trunk and ordinary roads. Side slopes. Metalling with stone, laterite, kankar and brick. Specification.

(2) *Survey.*—Trial lines of levels. Height of banks. Cross section. Culverts. Drawings and estimate.

(3) *Construction.*—Pegging out centre line. Laying out curves. Earthwork. Drainage. Details of culverts. Metalling. Rollers. Maintenance and repair.

(4) *Hill Roads.*—Tracing. Gradients. Cross section. Retaining walls. Catchwater drains. Side gutters. Culverts. Parapets

(c) Railway Construction.

(1) *Preliminary.*—Reconnaissance. Maps. Trial surveys and sections. Bench marks. Trial pits. Working survey and section. Land plans showing widths and areas required. Land Acquisition Act.

(2) *Construction.*—Pegging out centre line. Laying out curves. Earthwork. Tunnels.

(3) *Bridgework.*—Formation and rail level. Over and under bridges. Culverts, siphons and drains. Level crossings.

(4) *Permanent-way.*—Ballast. Gauge. Timber and iron sleepers. Chairs. Forms of rails. Fish plates. Cant of rails. Elevation of outer rails on curves. Sidings. Switches and crossings. Platelaying.

(5) *Mountain Railways.*—Adhesive system. Stationary engines. Centre-rail inclines.

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* In connection with this subject, the following practical work will be executed during the course in Surveying:—Pegging out straight lines and curves; running lines of levels, and taking cross sections; setting out and measuring up earthwork.

(6) *Rolling stock.*—Locomotives. Resistances to be overcome. Tractive force. Consumption of fuel and water. Passenger carriages and goods wagons. Brakes.

(7) *Stations.*—Passenger and goods stations. Locomotive and carriage sheds. Platforms. Watering tanks. Signals. The block system.

(8) *Tramways.*—Varieties of rails. Section of road. Means of draught. Single rail tramways. Wire tramways. Traction engines.

E.—HYDRAULICS, IRRIGATION WORKS AND SANITARY ENGINEERING.*

(1) **Hydrostatics.**—Water. Hydrostatic Laws. Pressure at a point and on a surface. Equal transmission of pressure. Atmospheric pressure. Siphon. Specific gravity. Flotation.

(2) **Discharge from Orifices and Notches.**—Volume of flow. Principle of continuity. Small orifices. Velocity of discharge. Co-efficients of velocity, contraction, and discharge Adjutages. Short pipes. Large orifices. Rectangular notch and orifice. Triangular notch. Velocity of approach. Submerged and partly submerged orifices. Submerged notch.

(3) **Practical cases of discharge from Orifices and Notches.**—Tank surplus weirs. Drowned weirs. Gauging weirs. Anicuts with clear overfall or drowned. Sluices; head, under, tank weir, lock and irrigation. Bridge openings. Afflux, backwater. Modules.

(4) **Discharge under variable Head.**—Free discharge from prismatic vessels. Time of emptying or filling. Discharge during a given time. Canal locks. Discharge from irregular basins. Discharge from one prismatic vessel into another.

(5) **Flow of water in Pipes.**—Fluid friction. Velocity in pipes. Virtual slope. Darcy's co-efficients of friction. Velocity and discharge. Short pipes. Siphon sluice. Inclination of pipes Branched mains. Pipes not running full. Minor losses of head. Jets.

(6) **Flow of water in Channels.**—Open channels. Basin's co-efficients. Channel section. Discharge. Trapezoidal section in earth. Practical data. Channels of minimum border. Channels for variable discharge. Variation of velocity in a cross section. Falls. Standing waves.

(7) **Rivers.**—Estimation of discharge. Maximum flood discharge from catchment basins. Ryves' and Dickens' formulæ. Bends in rivers. Régime of rivers.

(8) **Storage and distribution of Water.**—Supply for irrigation, navigation or to a town. Rainfall. Supply from wells, rivers and reservoirs. Water lifts and pumps.

(9) **Anicuts.**—Selection of site. Details of construction; foundations, body-wall, binding walls, retaining wall, crest, aprons. Under sluices. Head sluice. Wings. Different types of anicut in Southern India.

(10) **Canals and Channels.**—Irrigation canals in deltaic and non-deltaic country. Supply from rivers and tanks. Capacity of canal. Limiting velocities. Fall. Side slopes. Alignment. Disposal of cross drainage;

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* Inspection will be made of the Redhills tank, and Madras water-supply system. Drawings of Irrigation works and estimation of catchment areas will be made during the Drawing course. Levelling for channels, and contouring tank basins will be performed during the Surveying course.

aqueducts, superpassages, inlets and outlets. Height of banks. Drops. Head sluices for distributaries. Navigable canals. Limiting velocity. Locks, lock weirs, tow-paths, head-way at bridges.

(11) **Tanks.**—Isolated rainfed tanks. Tanks in groups. Tanks supplied by rivers or streams. Capacity. Irrigating duty. Loss of water by evaporation and absorption. Construction of earthen bunds. Puddle walls. Revetment of earthen bunds. Design and construction of surplus weirs. Tank sluices and their regulation. Repairs to bunds, and closing breaches.

(12) **Water-supply of Towns.**—Quantity and quality required. Clarke's soap test. Clarke's softening process. Gravitation and pumping schemes. Supply from wells and rivers. Well sinking and boring. Artesian wells. Reservoirs, main and service. Pumps. Filter beds. Sizes and forms of pipes. Laying pipes. Hydrants and stand pipes. Water meters. Constant and intermittent systems. Action of lead pipes on water.

(13) **Town Drainage.**—Sewage. Drainage of surface and subsoil. Removal of refuse. Open drains. Oval sewers. Pipes. Man holes. Outfall. Intercepting sewers. Construction of sewers. Traps. Ventilators. Sewage farms. Dry-earth system. Purification of sewage. Flushing of sewers. Cess-pits. Pneumatic system. Storm water.

F.—APPLIED MECHANICS.*

(1) Stiffness and Strength of Materials.

(*a*) *Preliminary.*—Stress and strain. Elastic limit. Modulus of elasticity. Rupture. Ultimate strength. Proof and working load. Factor of safety.

(*b*) *Tension.*—Simple tension. Work done in stretching a bar. Modulus of resilience. Tension in thin cylinders. Suddenly applied load. Practical estimation of strength of timber and iron tension bars, and of ropes and chains Design of tension bars and their joints in timber and wrought iron. Riveted joints in punched and drilled plates. Strength of boilers.

(*c*) *Compression.*—Distribution of stress in a cross section. Failure by combined bending and compression. Modes of failure. Attachment of ends. Formulæ of Gordon, Hodgkinson and Euler. Compression of thin cylinders. Estimation of strength of struts in timber, cast iron, and wrought iron. Design of struts and their joints. Compression in masonry structures.

(*d*) *Bending.*—Simple bending. Neutral axis. Shearing stress. Equality of bending and resisting moments. Calculation of, and graphical representation of shearing stresses and bending moments in beams under stationary and moving loads. Resisting moments of rectangular, flanged, tee, channel, rail and other sections by analytical and graphical methods. Practical estimation of the strength of timber and cast iron beams, and of rolled and built up wrought iron beams. Design of timber and small iron beams. Relation between shearing stress and bending moment. Distribution of shearing stress. Design of plate webs. Detailed design of a small plate girder with parallel flanges, including covers, wrappers, stiffeners, rivets, &c. Fixed and continuous uniform beams. Theorem of three moments. Deflection of solid and built up beams. Camber. Permanent set. Practical measurement of deflection. Stability of masonry structures against overturning under the pressure of earth or water.

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* The treatment of this subject will have special reference to the application of the principles enunciated to the practice of design.

The order in which the different branches of the subject are entered in the syllabus need not be adhered to instruction. For instance, *Framework* should be taken up before *Bending* has been completely disposed of. The portions of the syllabus relating to Design will be carried out for the most part in the time devoted to Drawing.

(e) *Shearing and Torsion.*—Nature of tangential stress. Torsion. Torsional moment, and moment of resistance. Diameter of shafting.

(*f*) *Strain beyond elastic limit.*—Flow of solids. Apparent and true tenacity. Compression of ductile and rigid material. Effect of repetition of the same and different stresses. Fatigue. Factors of safety. The testing of iron, cement, stone, &c.

(2) **Statics of Structures.**

(*a*) *Framework.*—Free joints. Complete and incomplete frames. Funicular polygon. Equilibrium of external forces. Equilibrium of forces and stresses at each joint. Graphical method of determining stresses by frame and stress diagrams. Automatic checks. Application to triangular frame. Bow's lettering.

(*b*) *Roof frames.*—Vertical load. Effect of wind. Graphical estimation of stresses in simple frames. Effect of changes of temperature. Design of timber roofs. Strength of joints. Design of iron roof frames.

(*c*) *Bridge frames.*—Dead and live loads. Bollman truss. Trapezoidal truss. Counterbracing. Design of a timber bridge frame. Practical estimation of stresses in Warren, N and Lattice frames, and application of the following methods:—(i) Method of sections, (ii) Polygonal method, (iii) Shearing stress diagram, (iv) Separate effects of partial loads. Design of a simple open web girder. Suspension chains Bowstring girders. Hinged girders. Arches. Determination of Line of Resistance in arches.

(3) **Kinematics of Machinery.**—Pairs of elements. Lower pairs. Restraint against sliding, turning and twisting. The Kinematic chain. The slider crank chain, crank chains, screw chains. Dead points in linkwork. Closure of the kinematic chain. Higher pairing. Connection of two lower pairs by higher pairing. Higher pairing by tension and pressure elements. Higher pairing of rigid elements. Rolling contact. The teeth of wheels. Cams and ratchets. The mechanics of machinery. Plane motion. The instantaneous centre, centrode and axode. Classification of simple and compound kinematic chains.

G.—PRINCIPLES OF MECHANISM.*

(1) **The conversion of Motion.**—Endless bands, straps, fast and loose pulleys, guide pulleys. Calculation of the amount of power capable of being transmitted by a given band or rope at a given speed. Comparison of the relative advantages of belts and ropes for transmitting power.

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* Special attention will be given to making correct hand-sketches of details of machinery.

Toothed wheels. Investigation of the forms of teeth for the transmission of motion or force in combinations of wheelwork. The rack and pinion. Spur wheels. Bevil and Mortise wheels. The crank and connecting rod. Cams. Mangle motions, ratchet wheels, detents, escapements. Quick return movements. Linkwork and parallel motions. Peaucellier's straight line motion. Trains of wheels for screw-cutting and clock-work. Epicyclic trains. Universal joints.

(2) **The Principle of work and its application to simple Machines.**—Levers, wheel and axle, pulleys, inclined plane, screw and wedge screw jacks, screw presses, crab winches, cranes double-geared machines and differential pulley blocks.

(3) **Friction.**—The laws of friction. Contrivances for lessening the effects of friction. Examples where friction is useful. Rolling friction. Brakes. Strap brakes. Dynamometers, and methods of measuring power. Estimation of the efficiency of machinery. Friction grips. Holding power of ropes when coiled.

(4) **True surfaces and the power of Measurement.**—Methods of measurement. Line and end measure. Rules. Callipers and gauges. Preparation of a true surface and a rectangular bar. Sir J. Whitworth's measuring machine.

(5) **Mechanical arrangements of Machines.**—Drilling, shaping, planing, slotting, boring and milling machines. Punching and shearing machines. Screw-cutting lathes. Printing machinery. Counting and numbering machines. Weighing machines. Clocks. Watches.

H.—THE STEAM ENGINE.*

(1) **History of the Steam Engine.**—Discoveries of Savery, Newcomen and Watt. Early history of marine and locomotive engines.

(2) **Generation of Steam.**—Fuels, furnaces and combustion, air required for combustion, grate and heating surface, evaporative power of fuels. Priming;—causes and remedies. Different sorts of water, and effect on evaporation. Loss of fuel by blowing out. Incrustation. Description of the principal forms of modern boilers for land, marine and locomotive engines. Strength of boilers, the use of stays; testing boilers. Details of boilers. Safety valves. Reverse or atmospheric valves, stop valves, glass water gauge. Various forms of steam pressure gauge. Feedwater heaters. Injectors and feed pumps.

(3) **The Stationary Steam Engine.**—General description of the principal forms of modern stationary steam engines. Details of the construction of the various parts, including steam cylinders, the forms of slide valve in common use, methods of balancing valves; the piston, metallic packing rings, the piston rod, stuffing boxes and glands; the steam jacket and clothing of the cylinder; the connecting rod, guide blocks and slides; crank and flywheel; the engine framing; the beam and parallel motions of beam engines. Methods of starting engines. Governors, and methods of regulating the speed of engines. Jet and surface condensers, the air pump, the hot well, force and circulating pumps.

(4) **Marine Engines.**—General description, advantages of compound and triple expansion engines; expansion and reversing gear. Thrust blocks. The propeller, various types of paddle wheels and screws. The propeller shaft.

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* Lectures on the steam engine will not be given until the students have completed the course of lectures on the theory of heat.

(5) **The Locomotive Engine.**—The general construction of a locomotive engine and boiler. The fire box, the inner and outer shell; the cylindrical barrel; the tubes, mode of fixing them; fire box stays, gusset stays, the ash pit; smoke box and blast pipe, mechanical action of the blast; the steam chest, the regulator; whistles; blow-off cocks; feed pumps. The reversing or link motion, connecting rods and eccentries. Inside and outside cylinders. Main frames, crank axle and driving wheels, power required for traction, adhesion of the driving wheels, sand boxes, axle boxes, bearing springs, buffer and draw springs. Automatic and non-automatic continuous brakes. The tender, water tank, feed heaters, Ramsbottom's method of filling the tank. Tank engines.

(6) **The Indicator Diagram.**—Description of the indicator, method of taking a diagram. Principal characteristics of an indicator diagram. The use of the diagram. The method of calculating the horse power of an engine from indicator diagrams.

IV.—DRAWING. MARKS, 500.

The course in Drawing will, as far as possible, follow that in Engineering. Thus, while such subjects as Building construction, Bridge construction, Irrigation works or Applied Mechanics are being studied in the Engineering courses, the drawing belonging to those subjects will be executed in the Drawing course The time devoted to Drawing will be about six attendances weekly of one and-a-half hours each. The practice of making neat dimensioned detail sketches on section paper or otherwise will be cultivated from the first. The course as laid down will occupy about two and-a-half years. The remaining time will be devoted to Building and Machine Drawing in connection with Engineering Projects and Designs.

(1) **Geometrical and Perspective Drawing.**—Use of drawing instruments. Scales. Simple problems in practical plane geometry. Plans, elevations and sections of simple solids. Isometric projection. Linear and angular perspective projections of geometrical solids and simple objects.

(2) **Freehand and Model Drawing.**—Ornamental outlines. Application of elementary perspective to model drawing of simple objects.

(3) **Building Drawing.**—Masonry details; bond, arching, footings, foundations, &c. Timber details; joints. Iron details; rivets, bolts, joints and connections. Drawing buildings from specification. Estimates for buildings. Orders and styles of architecture. Masonry bridges from specification and actual measurement. Estimates for bridges. Timber bridge. Iron roof on columns. Small plate girder bridge. Open web girder bridge. Irrigation works; anicut, head sluice, canal lock, tank weir, tank sluice, with estimates of quantities.

(4) **Machine Drawing.**—Shaft couplings and pedestals. Pulleys, spur wheels and bevil wheels. Connecting rods and cross heads. Details of simple machines.

(5) **Topographical Drawing.**—See Surveying Syllabus.

(6) **Applied Mechanics.**—Stress diagrams of roofs and bridges. Design of timber and iron roof and bridge frames. Lines of resistance in arches and masonry dams.

V.—SURVEYING. MARKS, 400.

Practical Fieldwork will be carried on during one full day in each week from January to April and from August to December. The classes will be divided into small squads working independently. Each member of a squad will be told off to a particular duty, and these duties will be interchanged once or twice daily. Lascars will not be employed for chaining, staff holding, &c., until students are perfect in these duties The instructor, having seen that each squad knows how to set to work, will leave it to its resources, carefully observing however each day, by instrumental check, the accuracy of the work done, and its amount. For plotting surveys and for topographical drawing, two or three attendances a week will be allowed. Occasional lectures will be delivered on the construction and adjustment of instruments, &c. The following course will occupy about two years and-a-half. The remaining time will be given to special surveys in connection with Engineering Design.

(1) **Topographical Drawing.**—Printing. Scales. Conventional signs. Colouring. Copying maps and survey plans. Estimation of areas. Use of Planimeter. Plans and sections of contoured ground. Plan of road or railway on contoured ground, showing cuttings and embankments. Cross sections. Estimate of earthwork. Hill shading with pen and brush.

(2) **Chain.**—Chaining in the field. Station and tie lines. Offsets. Obstacles. Chain Survey executed in the field and plotted. Estimation of area.

(3) **Compass.**—Prismatic and surveying compasses. Traversing. Checking angles. Compass Survey of about 600 acres. Plotting. Variation of compass.

(4) **Plane table.**—Plane table survey of about 600 acres.

(5) **Levelling.**—Dumpy, Y, and reversible levels. Longitudinal and cross sections. Check levels. Levelling for road, railway, or channel, not less than one mile, with cross sections. Formation level. Gradients. Plotting, and estimation of earthwork. Setting out earthwork. Contouring a hill or tank bed, by following successive contours, and by levelling along parallel lines. Plotting.

(6) **Theodolite.**—Common, Everest, and transit theodolites. Traversing. Gale's traverse system. Traverse in the field of about 600 acres. Interior filling in with compass or plane table. Plotting. Measurement of heights and distances. Setting out railway curves in the field. Pegging straight lines and curves. Triangulation; base line, angular measurements, calculations. Small triangulation in the field. Interior filling in with plane table or compass.

(Signed) H. D. LOVE, Major, R.E.,
1893. *Principal, College of Engineering.*

SYLLABUSES.

ENGINEER SUBORDINATE CLASS.

I.—MATHEMATICS.* MARKS, 370.

A.—ARITHMETIC.

The whole subject.

B.—ALGEBRA.

The representation of unknown quantities. The signs plus and minus. The use of brackets. Numerical evaluation of algebraic expressions. Addition. Subtraction. Multiplication. Division. Fractions. Highest common factor. Lowest common multiple. Addition, subtraction, multiplication and division of fractions. Involution and evolution. Indices. Simple equations with one or more unknown quantities. Quadratic equations.

C.—GEOMETRY.

Euclid, Books I, II, III, and IV, with easy deductions.

D.—PLANE TRIGONOMETRY.

Measurement of angles. Trignometrical functions of an angle, and their values in special cases. Formulæ including angles which have the same sine, cosine or tangent. Functions of the sum or difference of two angles. Logarithms, and the use of logarithmic tables. Properties of triangles. Solution of triangles. Measurement of heights and distances.

E.—MENSURATION.

The whole subject.

F.—ELEMENTARY STATICS.

Definitions of mass and force. Measurement of mass and force. Geometrical representation of forces. The parallelogram of forces. The triangle and polygon of forces. Composition and resolution of forces. Parallel forces. Couples. Theory of moments. Conditions of equilibrium of a system of forces in one plane. Centre of gravity. Simple machines. The efficiency of machines. The principal of virtual work applied to machines. The laws of friction. Friction in connection with machines.

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* In the course in Trigonometry, special attention will be paid to the practical solution of triangles required in Surveying.

The course in Statics will be taught with the aid of experimental apparatus, and will have a special bearing on Engineering problems. Graphical methods of solution will be employed.

II.—ENGINEERING. MARKS, 600.

A.—BUILDING MATERIALS.*

(1) **Stone.**—Varieties met with in Southern India. Quarrying. Blasting with powder and dynamite. Dressing. Average strength and weight of stone.

(2) **Bricks and Tiles.**—Brick earth. Tempering. Pug mills. Hand and machine, ground and table moulding. Drying. Burning in clamps and kilns. Hoffman's kiln. Pressed bricks. Coloured bricks and tiles. Fire bricks. Roofing, flooring and drain tiles. Patent tiles. Characteristics of good bricks and tiles. Average strength and weight of bricks.

(3) **Limes and Cements.**—Sources and properties of lime. Burning. Slaking. Varieties of lime. Manufacture of Portland cement in Madras. Properties of Portland cement. Roman cement. Practical tests.

(4) **Mortar, Concrete and Plaster.**—Hydraulic mortar. Mortar mixing. Surki. Concrete. Strength of mortar and concrete. Plaster. Pointing. White and colour washing.

(5) **Timber.**—Growth and felling. Seasoning, natural and artificial. Conversion. Preservation. Varieties used in Southern India. Strength and weight of timber. Characteristics of sound timber.

(6) **Metals.**—(Brief general description only required). Grey and white pig iron. Castings. Pipes and columns. Tests for and strength of cast iron. Wrought iron manufacture. Wrought iron in plates, bars and sheets. Galvanised iron. Rivets and bolts. Punching and drilling. Cutting plates and bars. Riveting. Welding. Tests for and strength of wrought iron. Steel, hard and mild. Tests for, and strength of steel. Tempering of steel. Copper. Zinc. Lead. Tin. Alloys. Solder.

(7) **Paints and Varnishes.**—Ingredients of paint. Mixing and applying. Painting old and new work. Putty. Wood oil. Coal tar. Distemper. Varnish. Papering. Glazing.

B.—BUILDING CONSTRUCTION.†

(1) **Masonry.**—Coursed and uncoursed rubble. Ashlar and block in course. String courses and copings. Bricklaying. English and Flemish bond. Bond at angles of walls, in footings with offsets, between main and cross walls, at door and window openings and in circular pillars. Foundations and footings. Plinth. Damp proof course. Thickness of main and cross walls. Wall plates. Wood bricks and plugs. Openings for timber beams. Door and window openings. Corbelling. Brick-arches, flat, seg-

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* Visits of inspection will be made to the following and other works:—
(a) Pallávaram stone quarries
(b) Perambúr brickfields
(c) Government brickfield, Poonamallee Road.
(d) Lime-kilns, Cockrane's basin.
(e) Madras cement works.
(f) Gun Carriage Factory or other foundry.

Written reports are not required, but students will submit note books of dimensioned sketches illustrative of the processes witnessed. These note books will carry marks.

† Great stress is laid on the importance of making large size detail sketches, completely dimensioned. Visits of inspection will be made to buildings in progress, and note books of sketches will be submitted. A building will be set out on the ground.

In connection with this subject, Building drawings will be executed as part of the Drawing course.

mental, pointed and relieving. Inverts. Centres for small arches. Bond in brick and stone arches. Small oblique arches. Enclosure walls. Buttresses and counterforts. Retaining walls. Scaffolding.

(2) **Foundations.**—Foundations for walls. Excavation. Masonry and concrete foundations. Benching out. Weight and spread of foundations. Foundations in wet and soft soils. Piles. Coffer dams. Well foundations. Sinking wells. Excavators. Iron wells. Methods of keeping wet foundations dry. Setting out buildings on the ground from working plans.

(3) **Carpentry.**—Mortise and tenon joints. Fishing and scarfing. Iron straps and bolts. Roof frames, nature of stress in the different members. Detail of joints of roof trusses. Frames of timber and iron combined. Trussed beams. Timber floors. Staircases, designing and setting out. Doors and windows. Centerings for arches. Striking centres.

(4) **Roofs and Floors.**—Terrace roofs and floors on joists, beams and joists, or iron girders and joists. Covering of bricks, tiles, concrete and plaster. Bengal terrace. Fire-proof floors. Iron-tied brick arched roofs. Pitched roofs. Couples. Trusses. Rafters, purlins and reepers. Tiled and thatched roofs. Ceilings. Floors of stone, brick, tiles, concrete and asphalte. Simple forms of iron roofs. Joints and connections. Roofing with patent tiles and corrugated iron. Ventilation of roofs.

C.—BRIDGE CONSTRUCTION.*

(5) **Site, Waterway and Design of Bridges.**—Choice of site. Nature of stream or river, and its bed and banks. Purpose of bridge. Waterway. Estimation of velocity and discharge in maximum floods. Permissible velocity. Afflux. Choice of material; timber, brick, stone, and wrought iron. Setting out bridges on the ground with straight and splayed wing walls.

(6) **Temporary Bridges.**—Paved causeways. Spar bridges. Suspension bridges. Bridges of boats and pontoons. Width of roadway. Swing openings.

(7) **Masonry Bridges.**—Strength of masonry. Solid, well and pile foundations. Flooring of bridges. Arches, segmental, elliptic and many-centered. Setting out arches full size. Piers and abutments. Skew-backs, cut-waters, wing-walls, thickness of arch rings. Centerings. Setting out courses on centres. Bond. Spandrils. Face walls. Blocking course and parapets. Roadway. Drainage. Approaches. Oblique arches.

(8) **Timber Bridges.**—Masonry abutments. Timber, or masonry piers. Crib-work piers. Frames of timber, or timber and iron combined.

Abutting frames. Trapezoidal truss. Lattice frames. Superstructure. Arched ribs of planks.

(9) **Iron Bridges.**—(Brief general description only required). Foundations, solid, well and iron cylinders. Masonry piers, abutments and wing walls. Forms of iron used for bridges. Punched and drilled rivet holes. Chain and lozenge riveting. Pin connections. Rolled beams. Simple plate girder bridges with parallel flanges. Open web girders. Erection of girders. Support of ends, and allowance for expansion.

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* Great stress is laid on the importance of making large size detail sketches, completely dimensioned. Visits of inspection will be made to bridges in progress or completed, and a bridge will be set out on the ground.

In connection with this subject, Bridge Drawings will be executed as part of the Drawing course.

D.—EARTHWORK AND ROADS.

(1) **Preliminary.**—Selection of line. Preparation of working plans, longitudinal and cross sections. Borings and trial pits. Equalizing cuttings and embankments. Embankments from side pits. Spoil banks. Practical stability of earth. Side slopes for different soils. Excavation in rock. Calculations of earthwork. Prismoidal formula.

(2) **Setting Out.**—Marking centre line. Setting up cross sections. Allowance for settlement and shrinkage. Setting out on side long ground.

(3) **Embankments.**—Breaking lumps and clods. Embanking on a slope. Punning or ramming. Repairs and additions. Tank bunds. Puddle walls.

(4) **Cuttings.**—Staging and plank runs. Horse runs. Steps and ramps.

(5) **Slopes and Drainage.**—Dressing and trimming slopes of embankments and cuttings. Protection of slopes with turf or stone pitching.

(6) **Tools and Plant.**—Clinometer. Ghaut tracer. Spirit level, Mason's level. Boning rods. Wheel and hand barrows, earth wagons, baskets, mamoties, pickaxes, shovels and spades, crowbars.

(7) **Roads.**—Direction. Survey and levels. Longitudinal and cross sections. Drainage. Fair weather and permanent roads. Road in swampy ground. Trunk and ordinary roads. Earthwork, bridges, culverts and drains. Metalling. Rollers. Maintenance and repairs. Hill roads, tracing and execution, drainage, retaining walls, and maintenance.

E.—HYDRAULICS AND IRRIGATION WORKS.*

(1) **Hydrostatics.**—Hydrostatic laws. Pressure at a point and on a surface. Equal transmission of pressure. Atmospheric pressure. Siphon. Specific gravity. Floatation.

(2) **Discharge from Orifices and Notches.**—Small orifices. Velocity of discharge. Co-efficients of velocity, contraction and discharge. Rectangular orifice and notch. Triangular notch. Velocity of approach. Submerged and partly submerged orifices. Submerged notch.

(3) **Practical Cases.**—Tank weirs. Drowned weirs. Gauging weirs. Anicuts. Sluices; head, under, lock and tank. Modules.

(4) **Discharge under variable head.**—Free discharge from prismatic vessels. Time of emptying or filling locks. Discharge from one prismatic vessel into another.

(5) **Flow in Pipes.**—Fluid friction. Velocity in pipes. Virtual slope. Discharge. Inclination of pipes. Pipes not running full.

(6) **Flow in Channels.**—Sections for channels. Bazin's co-efficients. Discharge of channels. Practical data. Channels of minimum border. Falls.

(7) **Rivers.**—Cross sections. Measurement of velocity and discharge. Flood discharge from catchment basins. Bends. Régime of rivers.

(8) **Storage and Distribution.**—Irrigation, navigation and town supply. Rainfall. Supply from wells, rivers and reservoirs. Water lifts and pumps.

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* Inspection will be made of the Redhills tank, and Madras water-supply system. Drawings of Irrigation works and estimation of catchment areas will be made during the Drawing course. Levelling for channels and contouring tank basins will be performed during the Surveying course.

(9) **Anicuts** —Types, and details of construction. Body and retaining walls. Aprons. Wing walls. Head and under sluices.

(10) **Canals and Channels.**—Irrigation in deltas and elsewhere. Supply from rivers. Storage in tanks. Capacity of channel, limiting velocity. Surface fall, side slopes, alignment. Cross drainage. Falls or drops. Navigation canals. Locks.

(11) **Tanks.**—Isolated rain-fed tanks. Tanks in groups. Tanks supplied from rivers or streams. Catchment and capacity of a tank. Irrigating duty of water. Tank bunds, puddle walls, revetment. Surplus weirs. Tank sluices. Closing breaches.

(12) **Supply of Towns.**—Quantity and quality. Source of supply. Wells. Main and service reservoirs. Filter beds. Pumping. Laying pipes.

(13) **Town Drainage.**—Sewage and sewers. Open drains. Storm water. Disposal of sewage. Ventilation of sewers.

F.—APPLIED MECHANICS.*

(1) **Preliminary.**—Specific gravity. Energy. Unit of work. Horse power. Load, dead and live. Stress and strain. Modulus of elasticity. Hooke's law. Modulus of rupture. Ultimate strength. Proof and working load. Factor of safety. Suddenly applied load. Resistance of building materials to stress. Effect of continued applications of stress. Fatigue in materials.

(2) **Tension.**—Stress in a cross section. Estimation of strength of timber and iron tension bars, ropes, &c. Design of tension bars and their joints in timber and wrought iron. Riveted joints in punched and drilled plates.

(3) **Compression.**—Stress in a cross section. Failure partly by crushing and partly by bending. Short bars. Modes of failure. Long bars. Strength dependent on mode of attachment of ends. Gordon's formula. Hodgkinson's formulæ for bars of cast iron. Estimation of strength of struts in timber, cast iron, and wrought iron. Design of simple and compound struts.

(4) **Transverse Stress.**—Cantilevers. Girders. Beams. Shearing stress. Bending moment in a beam. Resisting moment of a cross section. General equations of transverse stress. Bending moments and shearing stresses in cantilevers, loaded at end, and uniformly; and in supported beams, loaded at middle, at any point, and uniformly. Graphic representation of bending moment and shearing stress, to scale. Resisting moment of a rectangular section, and of a flanged section with a thin web.

(5) **Solid Rectangular Beams.**—Equation of bending and resisting moments. Modulus of rupture by cross breaking. Estimation of strength of timber beams. Their design. Neglect of shearing stress. Empiric formulæ. Strongest beam from a cylindric log. Deflexion. Amount allowable. Modulus of deflexional elasticity. Formulæ for deflexion. Stiffest beam from a cylindric log. Simultaneous direct and tansverse loading. Design of beams so loaded.

(6) **Flanged Beams.**—Equation of bending and resisting moments. Equation of shearing stress and shearing resistance. Cross section of uniform strength for cast and wrought iron. Beam of uniform strength. Uniform beams. Strength and design of small cast iron beams. Strength

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Stress diagrams will be drawn during the hours set apart for Drawing.

and design of small plate girders. Rolled beams. Empiric formulæ for strength of rolled beams.

(7) **Framed Structures**.—Assumption of free joints. Bracing bars. Perfectly and imperfectly braced frames. Distribution of load. Equilibrium of external forces on structure. Equilibrium of external forces and internal stresses at each joint. Graphic method of determining stresses. Frame diagram. Stress diagram. Reciprocal stress diagram. Application to a triangular frame. Bow's lettering.

(8) **Roofs.**—Vertical load on roofs. Its distribution. Graphic estimation of stresses in king rod, queen rod, and other simple trusses. Effect of wind on roofs. Amount of maximum normal pressure. Distribution. Graphic estimation of stress due to wind. Design of timber roofs. Principal rafters bearing direct, or direct and transverse loads. Strength of joints. Design of small iron trusses loaded only at the joints.

(9) **Framed Bridges, &c.**—Simple road bridges. Difference between roof and bridge frames. Dead and live loads. Triangular frame, Graphic method. Abutting structures. Bollman truss. Trapezoidal truss. Counterbracing. Simple frames with parallel chords. Design of such frames in timber, or timber and iron combined. Miscellaneous structures, such as jib crane, derrick crane, sheers, braced cantilevers.

(10) **Masonry Structures.**—Composition. Load. Graphic method of determining pressure of water or earth on retaining walls. Approximate rules for thrust of arches Modes of failure of structures; overturning, crushing, sliding. Conditions of stability. Line of resistance. Its position for safety. Graphic determination of its position. Design of walls. Conversion of rectangular into trapezoidal section having equal stability.

G.—MECHANISM AND THE STEAM ENGINE.

(1) **Conversion of Motion.**—Endless bands, straps, belts, fast and loose pulleys, guide pulleys. Calculation of the power which a given belt or rope can transmit at a given speed. Toothed wheels. Spur wheels. Bevil and mortise wheels. Conversion of reciprocating into circular motion and *vice versâ*. Rack and pinion. Cams. Mangle motions. Quick return movements. Trains of wheels for screw-cutting. Clockwork.

(2) **Principle of Work.**—Levers, wheel and axle. Chinese windlass, pulleys, inclined planes, screw and wedge, screw jacks, screw presses. Crab winches. Cranes. The differential pulley block.

(3) **True Surfaces and the Power of Measurement.**—Methods of measurement. Rules, callipers, gauges. Line and end measures. Preparation of true surfaces and rectangular bars.

(4) **Mechanical arrangements of Machines.**—Drilling, shaping, planing, slotting, boring and milling machines. Punching and shearing machines. Screw-cutting lathes. Weighing machines.

(5) **The Steam Engine.**—General description of the principal forms of stationary engines and boilers. Details of construction of ordinary appendages to boilers. Details of construction of steam cylinders, slide valves, pistons, piston rods and cross heads, stuffing boxes and glands, steam jackets and cylinder lagging, connecting rods, cranks and crank shafts. Engine frames, beams and parallel motion of beam engines. Jet and surface condensers, the air pump, hot well and circulating pump.

III.—DRAWING. MARKS, 400.

This course will be worked in connection with that in *Engineering*. Thus, if Building construction or Bridges, or Applied Mechanics, or Mechanism be the subject under consideration in the Engineering course, the Drawing work pertaining to that subject will, as far as possible, be executed contemporaneously in the hours devoted to *Drawing*.

I. Practical Plane and Solid Geometry.—Use of drawing instruments. Simple problems on straight lines. Construction of plain and diagonal scales. Simple problems on lines and circles. Reduction of a rectilineal figure to a triangle. Parabola. Ellipse. Planes of projection. Representation of a point in space in all positions with respect to the plane of projection. Plans and elevations of straight line, cube, and prism, placed in any position. Plans and elevations of pyramid, cone and cylinder in any position. Sections of the above solids made by any plane.

II. Free-hand and Model-drawing.—Ornamental outlines from copies, drawing geometrical solids, and simple objects, such as a table, box, &c. Application of elementary perspective to model-drawing.

III. Buildings.—Conventional colours. Conventional rules for shade lines and shadows. Details of masonry, such as foundations; walls; segmental, pointed, flat, and relieving arches. Details of carpentry, such as joints, roof-frames, doors, staircases. Details of roofs and floors, such as terracing, roof-covering; fire-proof floors. Details of iron work, such as rolled beams, cast iron columns, iron-roof joints. Tracing on cloth. Drawing buildings from specification. Taking out quantities and preparing detail and abstract estimates of quantities and cost. Earthwork estimates.

IV. Bridges. -*Masonry Bridges.*—Bridge foundations on rock, and on wells. Construction of piers, abutments, and wingwalls. Arches, segmental, elliptic and many-centered. Modes of filling spandrils; face and parapet walls. Drawing from specifications. Estimates.

Timber Bridges.—Frames of timber, or timber and iron combined. Joints, superstructure. Drawing from specifications. Estimates.

Iron Bridges.—Wrought iron plates and bars. Rivets. Construction of plate girders; flanges, web, angles, stiffeners, covers, wrappers. Support of ends. Main and cross girders, superstructure. Braced girders. Drawing from models or actual measurements.

V. Irrigation Works.—Nature of the storage, distribution and regulating works of an irrigation system; anicuts, head sluices, canal falls, locks, inlets and outlets, tank escapes, tank irrigation sluices. Drawing irrigation works from models and specifications. Estimating.

VI. Machinery.—Conventional shading and colouring. Drawing simple pieces of machinery from models, such as a belt-pulley, a pulley block and chain, a plummer block, a toothed wheel, a V or square screw thread.

PLANS AND ESTIMATES

to be prepared during the course.

Practical Plane Geometry, five sheets.*
Practical Solid Geometry, three sheets.*

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* The problems in Geometrical Drawing are on no account to be copied. Each construction will be demonstrated on the black board; and every student will then draw the figure in his own way.

Masonry details.
Timber details.
Iron-roof details.
Tracing on cloth, and colouring a drawing of a building.
Small building with couple roof. Estimate.
Building with terrace-roof, drawn from model. Estimate.
Building with pent roof, drawn from specification Estimate.
Masonry bridge, drawn from specification. Estimate.
Masonry bridge, drawn from actual measurements. Estimate.
Timber bridge, drawn from specification. Estimate.
Iron plate girder bridge, from model or actual measurements. Estimate.
Head sluice, drawn from model or specification. Estimate.
Canal lock, from model. Estimate.
Tank escape, from model or specification. Estimate.
Tank distribution sluice, from model or specification. Estimate.
Free-hand drawing, two sheets.
Perspective drawing, three sheets.
Model-drawing, five sheets.
Rivets and riveted joints.
Bolts and nuts, screws, keys and cotters.
Shaft couplings and pulleys.
Shaft pedestal.
Spur wheel.
Bevil wheel.
Simple machine, drawn from measurements.

IV.—SURVEYING. MARKS, 350.

The whole of one day in each week will be set apart, except during the months of April and May, for field work. Students may, however, be sent out into camp for a fortnight at a time.

NOTE.—Students will be formed into small squads, the size of which will be regulated by the nature of the survey under execution. Every student of a squad will be told off to a particular duty, and these duties will be frequently interchanged. The instructor will show each squad how to commence work and will then leave it to its own resources, visiting it only occasionally. He will check independently the accuracy of the work performed. Each student must be fully practised in every detail of the work required in the field, such as chaining, holding levelling staves, observing, &c.

1. **Drawing.**—Printing in plain block and small italic. Construction and use of plain, comparative, and vernier scales. Reduction of a rectilineal figure to a triangle. Conventional signs. Colouring.

2. **Chain.**—Structure and use of the chain. Chaining in the field. Incorrect chain. Chaining on a slope. Off-sets. Cross staff. Optical square. Obstacles. Ill-conditioned triangles. Station lines. Tie lines. Hand sketch. Field book. Plotting. Estimation of areas. Chain angles. Heights and distances without instruments.

3. **Compass.**—Prismatic and surveying compasses. Measurement of horizontal angles. Traversing. Checking angles. Field book. Plotting. Variation of compass.

4. **Plane Table.**—Surveying with the plane table and chain.

5. **Levelling.**—Dumpy, Y, and reversible levels, and their adjustments. Levelling staves. Use of the level. Field book. Bench marks. Datum line. Check levels. Longitudinal and cross sections. Corrections for curvature and refraction. Water level. Running levels for road, railway, or channel. Centre line. Formation level. Gradients.

6. **Theodolite.**—Common or ordinary theodolite. Everest's theodolite. Adjustment. Measurement of horizontal and vertical angles. Estimation of heights and distances.

7. **Traversing.**—Traversing with the theodolite. Gale's traverse system. Use of traverse tables. Interior filling in with compass or plane table.

8. **Contouring.**—Nature of contours. Drawing contours in plane slope such as the sides of a railway cutting on a gradient. Contouring with the level: (1) by following successive contours; (2) by levelling along parallel lines.

9. **Curves.**—Radius. Tangent points. Pegging out curves: (1) by chords and offsets; (2) by angles at the circumference.

PLANS AND SURVEYS

to be executed during the Course.

Printing.

Scales

Chain Survey of about 30 acres, executed in the field. Station and tie lines only to be plotted. Estimation of area. Field book.

Plan of country, introducing conventional signs, to be drawn and coloured.

Chain survey of about 60 acres, executed in the field, showing details, and coloured. Field book.

Chain and compass survey of about 100 acres, executed in the field, showing details. Estimation of area. Field book.

Copying a survey to a changed scale.

Plane table survey of about 50 acres, executed in the field, and plotted.

Tracing a survey on cloth, and colouring.

Line of levels, half mile long, with not less than 10 cross sections, run in the field, and plotted. Field book.

Line of levels, one mile long, with cross sections, run in the field for a road, railway or channel, showing formation level.

Line of levels along a bank, not less than one mile in length, with cross sections every 660 feet.

Line of levels one mile long along a canal or river with cross sections not less than three in number for a river, and every 660 feet for a canal.

Traverse with the theodolite of about 100 acres, executed in the field, and filled in, half with compass and half with plane table.

Plate of heights and distances from observations made in the field, both with and without instruments.

Contour plate of hilly ground or of a tank bed. Lines to be run with the level in the field. Section on the above.

Hill shading a plate of contours with the pen, stump, or brush. Section.

Curve plate. Plotting curves from measurements made in the field.

(Signed) H. D. LOVE, Major, R.E.,

1893. *Principal, College of Engineering.*

SYLLABUS.

DRAFTSMAN CLASS.

NOTE.—Class instruction will be conveyed chiefly by the aid of the Blackboard and Models. None of the Geometrical drawing will be from copies. The Teacher will explain the mode of construction of a problem to the class, after which each student will proceed to make the drawing in his own way. The main object to be kept in view throughout the course is that students should be made intelligent draftsmen and not mere copyists. Lectures will be given on Building and Bridge construction, in illustration of which models will be freely used.

Students will be sent out from time to time to inspect works. Written reports are not required, but dimensioned sketches will be made, and the note-books containing these sketches will be put up at the end of each year with the plans and estimates which have been executed.

The order in which the different subjects are entered is not intended to be closely adhered to. Variety should be introduced into the student's work, which should never be of one kind for a longer period than three hours at a time. Thus, at the outset, a morning given to Geometrical Drawing may be devoted partly to a lecture, and partly to actual drawing, while the afternoon might be occupied in drawing details of Building construction.

I. **Practical Plane and Solid Geometry.**—Use of drawing instruments. Printing. Simple problems on straight lines. Construction of plain and diagonal scales. Simple problems on lines and circles. Regular polygons. Reduction of a rectilineal figure to a triangle. Parabola. Ellipse. Planes of Projection. Representation of a point in space in all possible positions with respect to the plane of projection. Plans and elevations of straight line, cube, square, triangular and polygonal prism, placed in any position. Plans and elevations of pyramid, cone and cylinder in any position. Sections of the above solids made by any plane. Interpenetrating solids. Isometric projection.

II. **Free-hand, Perspective and Model Drawing.**—Ornamental outlines from copies; decorative designs for buildings. Linear and angular perspective of geometrical plane and solid figures. Projection of simple objects, such as a table, box, &c. Elementary perspective applied to model drawing of simple objects.

III. **Buildings.**—Conventional colours. Conventional rules for shade lines and shadows. Projection of shadows. Details of masonry, such as foundations, walls, segmental, pointed, flat and relieving arches. Details of carpentry, such as joints, roof-frames, doors, windows, staircases. Details of roofs and floors, such as terracing, roof-coverings, fire-proof floors. Details of iron-work, such as rolled beams, cast-iron columns, iron-roof joints. General dimensions of rooms. Tracing on cloth Drawing buildings from models, specification, and actual measurement. Taking out quantities, and preparing detail and abstract estimates of quantities and cost.

IV. **Earthwork.**—Delineation of cuttings and embankments. Retaining walls. Gradients. Areas of earthwork sections by plotting. Estimation of volumes by prismoidal formula.

V. **Masonry Bridges.**—Bridge foundations on rock, or on wells. Construction of piers, abutments, and wingwalls, with empiric rules for their dimensions. Arches, segmental, elliptic, and many centered. Modes of filling spandrils. Face and parapet walls. Oblique arches. Drawing bridges from models, specification, and actual measurement. Estimates.

VI. **Timber Bridges.**—Frames of timber or timber and iron combined. Trapezoidal truss. Joints. Superstructure. Drawing timber bridges from models and specifications. Estimates.

VII. **Iron Bridges.**—Wrought iron plates and bars. Rivets. Construction of plate girders; flanges, web, angles, stiffeners, covers, wrappers. Usual proportions. Support of ends. Main and cross girders. Superstructure. Construction of braced girders. Cylinder foundations. Drawing iron bridges from models, specification, or actual measurement. Estimating.

VIII. **Irrigation Works.**—Nature of the storage, distribution and regulating works of an irrigation system. Anicuts. Head sluices. Distribution sluices. Canal falls. Locks. Inlets and outlets. Tank escapes. Tank irrigation sluices. Drawing irrigation works from models, or specification. Estimating.

IX. **Machine Drawing.**—Riveted work. Bolts, nuts, keys and cotters. Shaft couplings and pedestals. Pulleys. Spur and bevil wheels. Connecting rods and cross heads. Details of simple machines, such as a lathe, drilling machine, planing machine, &c.

X. **Topographical Drawing.**—Conventional signs. Map-drawing. Representation of ground by contours. Sections on contoured plans. Hill-shading.

PLANS AND ESTIMATES

to be prepared during the Course.

NOTE.—The plans need not be drawn in the precise order given below.

First year.

Printing, one sheet.
Scales, one sheet.
Practical Plane Geometry, four sheets
Practical Solid Geometry, four sheets.
Masonry details, drawn in orthographic or isometric projection, and coloured, four sheets.
Timber details, drawn in orthographic or isometric projection, and coloured, three sheets.
Iron roof on cast-iron columns, showing details, two sheets.
Tracing on cloth and colouring a drawing of a building.
Free-hand drawing, six sheets.
Perspective drawing, four sheets.
Building, drawn from specification. Taking out quantities.
Building, drawn from actual measurements. Taking out quantities.
Earthwork embankment and cutting. Taking out quantities.
Masonry bridge, from specification. Taking out quantities.
Masonry bridge, from actual measurement. Taking out quantities.
Skew bridge, from copy.
Timber bridge, from specification. Taking out quantities.

Second year.

Model-drawing, six sheets.
Topographical plan.
Contoured plan and sections
Plate girder bridge, from model.

Plate girder bridge (or a portion thereof) from actual measurements. Taking out quantities.

Braced girder, from copy

Head sluice, drawn from model. Taking out quantities

Canal lock, from specification. Taking out quantities

Tank escape, from specification. Taking out quantities.

Tank distribution sluice, from specification. Taking out quantities.

Hill-shading, one sheet.

Rivets and riveted joints.

Bolts and nuts.

Screw threads.

Shaft couplings.

Pedestal block.

Brackets and hangers

Pulleys.

Spur wheels.

Bevil wheels.

Finished elevation of a large building.

Finished drawing of a large machine, from model or actual measurements.

Details of machine.

(Signed) H. D. LOVE, Major, R.E.,

1893. *Principal, College of Engineering.*

SYLLABUS.

SURVEYOR CLASS.

The object of the course is to make each student a practical surveyor. With this view each division of the class will be sub-divded into squads, which will work independently of one another. Each squad will consist of the smallest number of students capable of working the survey. The students of a squad will interchange duties once a day or oftener, so that each may be exercised in every duty, whether it be observing, chaining, taking offsets, or marking points.

The instructor, having fairly started the squads, will leave them to their own resources. He will visit each squad however at least once a day, and will see that a proper amount of work is being executed He will further by daily instrumental observation keep a careful check on the *accuracy* of the work performed. Inaccurate work must always be re-surveyed Each of the two divisions of the class will occupy two full days a week in field work except during the months of April and May.

1. **Mensuration.**—*Lengths*—Right angled triangles. Similar figures. Circumference of circle. Arc of circle. Chords and tangents of circles. *Areas*—Rectangle. Parallelogram. Triangle. Quadrilateral. Regular polygons. Similar figures. Circle. Simpson's rule.

2. **Drawing.**—Use of drawing instruments and scales. Printing. Simple problems in geometrical drawing, such as—(1) to draw a line perpendicular, or parallel, or at a given inclination to a given line; (2) to divide a line in a given proportion, or into any number of equal parts ; (3) to reduce a given rectilineal figure to a triangle. Estimation of areas. The construction of plain, comparative, and vernier scales. Conventional signs. Tracing on cloth. Copying to changed scale. Colouring. Pantagraph. Planimeter.

3. **Chain.**—Structure and use of the chain. Incorrect chain. Chaining on a slope. Checking distances. Offsets. Cross staff. Optical square. Obstacles. Ill-conditioned triangles. Tie-lines. Field book. Plotting. Heights and distances without instruments.

4. **Compass.**—Prismatic and surveying compasses. Measurement of horizontal angles. Traversing. Checking angles. Field book. Plotting and protracting. Variation of compass. Interpolation.

5. **Plane Table.**—Surveying with plane table.

6. **Levelling.**—Dumpy and Y levels, and their adjustments. Levelling staves. Use of the level. Field book. Bench marks. Datum line. Checking levels. Longitudinal and cross sections. Corrections for curvature and refraction. Cushing's reversible level. Water level. Reflecting levels. Running levels for road, railway or channel. Centre line. Formation level. Gradients.

7. **Contouring.**—Nature of contours. Drawing contours on plane slopes, as the sides of a railway cutting on a gradient. Contouring with the level (1) by following successive contours, (2) by levelling along parallel lines. Drawing sections on contoured plans.

8. **Hill-shading.**— Scale of shade. Shading with the brush. Shading with horizontal hachures.

9. **Trigonometry.**—Trigonometrical functions. Use of logarithmic tables. Solution of triangles.

10. **Box Sextant.**—Use of box sextant. Adjustments. Reduction of angles to a horizontal plane. Measurement of heights and distances. Interpolation.

11. **Theodolite.**—Common or ordinary theodolite. Everest's theodolite. Measurement of horizontal and vertical angles.

12. **Traversing.**—Traversing with the theodolite. Gale's traverse system. Use of traverse tables. Interior filling in with compass or plane table.

13. **Curves.**—Radius. Tangent points. Laying out curves (1) by chords and offsets, (2) by angles at the circumference.

14. **Triangulation.**—Measurement and reduction of base line. Ill-conditioned triangles. Calculation of sides. Checking angles and sides. Satellite stations. Plotting and protraction. Interior filling in.

SURVEYS AND PLANS

to be prepared during the Course.

NOTE —The surveys need not be made in the precise order here indicated, but the whole of them must be executed during the course.

First year.

Printing, Geometrical Drawing, Scales, about four sheets.

Chain survey of about 5 acres, executed in the field. Station and tie-lines only to be plotted. Area to be estimated. Field book.

Conventional signs, in ink only.

Plan of country introducing conventional signs, in colour.

Chain survey of about 20 acres, executed in the field, showing all details. To be plotted and coloured. Field book.

Survey plan to be traced on cloth, and coloured.

Survey plan to be copied to a changed scale.

Chain and compass survey of about 150 acres, executed in the field. Boundary to be traversed and plotted, and area estimated. Field book.

Chain and compass survey of about 300 acres. Details to be filled in with plane table in the field. Fair copy to be made and finished. Field book.

Plane table survey of about one square mile executed in the field, and fair copied.

Circuit of levels run in the field and plotted. Field book. Check and flying levels.

Second year.

Line of levels, half mile long, with cross sections every 200 feet, run in the field, on the chain and compass survey above, but plotted on separate sheet. Field book.

Line of levels along a tank bund, one mile long, with cross sections at every 660 feet. Field book.

Line of levels along a canal or river, one mile long, with cross sections not less than three in number for a river, and at every 660 feet for a canal.

Line of levels, one mile long, with cross sections at every 660 feet, run in the field for a road, railway or channel, and plotted to show formation level. Field book.

Heights and distances from measurements with chain and box sextant.

Traverse with theodolite of about 150 acres, executed in the field, and filled in half with compass and half with plane table. Field book.

* Contouring with the level a piece of hilly ground. Contours to be plotted, and section and elevations and drawn. Field book.

Contouring a tank bed by parallel lines, run with the level. Field book. Plotting.

Shading a contoured plan with pen.

Shading a contoured plan with brush.

Plotting curves from measurements made in the field.

* Triangulation of from 5 to 10 square miles with theodolite Measurement and reduction of base. Calculation of sides. Plotting. Field book. Interior filling in as time permits.

* These surveys will be executed if possible near Pallavaram.

(Signed) H. D. LOVE, Major, R.E.,

1893. *Principal, College of Engineering.*

SYLLABUS.

ARTISAN CLASS.

I. ARITHMETIC.

The Compound Rules, Reduction, Vulgar and Decimal Fractions, Practice, Simple and Compound Proportion.

NOTE.—English figures must be used, and the candidates must be acquainted with the principal Indian Weights and Measures and the English Tables of Money, of Troy Weight, Avoirdupois Weight, of Lineal, Square and Cubic Measure, and of Time.

II. MENSURATION.

1. **Definitions** of the various figures concerned.

2. **Lengths.**—Right-angled triangles. Regular polygons. Similar figures. Circumference of a circle. Arc of a circle.

3. **Areas of Plane Surfaces.**—Rectangle. Parallelogram. Triangle. Quadrilateral. Regular and irregular polygons. Similar figures, circle. Sector and segment of a circle. Simpson's rule.

4. **Volumes.**—Rectangular parallelopiped. Prism. Pyramid. Cone and frustum of a cone. Cylinder. Sphere.

5. **Areas of curved surfaces.**—Right circular cylinder. Right circular cone. Frustum of a cone. Sphere. Zone and segment of a sphere.

6. **Miscellaneous.**—Measurement of timber, squared and unsqared.

NOTE.—*Students will be required to calculate areas and volumes from actual measurements of simple objects.*

III. BUILDING MATERIALS AND CONSTRUCTION.

A.—MATERIALS.

1. **Stone.**—Varieties met with in Southern India. Quarrying. Blasting with powder and dynamite.

2. **Bricks and Tiles.**—Brick earth. Tempering. Moulding. Drying. Burning. Firebricks. Roofing, flooring and drain tiles.

3. **Lime, Cement, Mortar, Concrete, Plaster.**—Properties of lime, burning, slaking, mortar mixing, surki, concrete. Practical tests for lime and cement. Plaster. Whitewash.

4. **Timber.**—Seasoning. Characteristics of sound timber. Varieties.

5. **Iron.**—Cast iron. Forms of wrought iron.

B.—CONSTRUCTION.

1. **Foundations.**—Setting out work. Foundations for walls. Masonry and concrete foundations. Wells. Excavators.

2. **Masonry.** Ashlar. Coursed and uncoursed rubble. Bricklaying in English and Flemish bond Bond at angles of walls, in footings, between main and cross walls, at door and window openings, and in circular pillars String courses, cornices, wall plates. Wood bricks and

plugs. Openings for timber beams. Brick arches, segmental, flat, and relieving. Centres for small arches Masonry bridges.

3. **Carpentry.**—Mortise and tenon joints. Scarfing. Bolts and straps. Roof frames and their joints. Dimensions of parts. Trussed beams. Doors and windows. Centres.

4. **Roofs and Floors.**—Terrace roofs and floors on joists or beams and joists. Dimensions of timbers. Pitched roofs. Rafters, purlins and reepers. Roof coverings. Simple iron roofs Floors of stone, brick and concrete. Fire-proof floors.

NOTE.—*Students will be constantly practised in making neat dimensioned hand-sketches.*

IV. PLAN-DRAWING AND ESTIMATING.

1. **Preliminary.**—Simple practical geometry. Scales Connection between plan, elevation and sections.

2. **Buildings.**—Modes of spreading weight over foundations. Bond at angles of walls, in footings, &c. Details of foundations. Thickness of walls in buildings. Arches Details of carpentry, such as joints, roof frames, doors and windows Details of roofs and floors, such as terracing, roof coverings. Iron roof joints. Estimates for simple buildings. Current prices.

3. **Earthwork.**—Areas for earthwork sections. Estimation of volumes.

4. **Bridges.**—Piers, abutments and wing walls, with rules for their dimensions. Segmental arches. Rules for rise and thickness of arches. Spandrils. Estimates of quantities.

NOTE.—*Students will be practised in making neat practical drawings to scale from notes or specifications. Drawings may be in pencil, and no coloring is required.*

(Signed) H. D. LOVE, Major, R.E.,
1893. *Principal, College of Engineering.*

College of Engineering, Madras.

STANDING ORDERS FOR STUDENTS.

ATTENDANCE.

1. The hours of attendance will be indicated on a board placed in a conspicuous position in the College, and the strictest punctuality in regard to studies will be observed. The senior student of each division will call the roll at 10, 11-30, 2 and 3-30, and will fill up the attendance register. He will do the same for Workshop, Gymnasium, Survey and other out-door attendances.

DRESS.

2. Every student will wear a turban or a decent cap, a long or short coat, buttoned up to the neck, with (*a*) trousers, socks and English shoes, or (*b*) a clean dhoti or mundu. As regards hair, tufts may not be worn pendent; the tuft must be drawn up and covered by the turban or cap. Within the precincts of the College hair is never to be worn flowing loose. In the case of students who wear their hair in the European style, the cap may be removed in-doors. All articles of dress must be scrupulously clean. Students may remove turbans, caps and coats when in the shops or gymnasium. All students engaged with or inspecting machinery are recommended to wear trousers and other close-fitting clothes, so as to minimise risk of accident.

DEMEANOUR.

3. Every student will salute the Principal, Professors, Instructors and Assistant Instructors (*a*) on the occasion of first meeting them for the day within the College precincts, (*b*) whenever he meets them in public. The salutation will be made in a proper and respectful manner, as from an inferior to a superior. When the Professor or Instructor enters a lecture-room, the students will rise, and will remain standing until they are desired to sit, or until the Professor or Instructor takes his seat. No student will leave a class-room without permission or until the class is dismissed.

LEAVE.

4. The vacations and holidays reduce the year to about 180 working days. Out of this, leave may be granted by the Principal not exceeding seven days in any one year (four days for the third division of the Engineer Subordinate class) to permit of the performance of annual and other ceremonies, of absence from slight indisposition, &c. Such casual leave must be regarded as a privilege, not as a right, and all absence in excess of the maximum number of days will be without leave, and subject to punishment, except on the production of a medical

certificate signed by a qualified medical practitioner. Punishment for absence without leave will be by fine, by exclusion from the library, by entry in the conduct register, or in aggravated cases by dismissal. Absence without leave will count against the seven (or four) days' leave permissible.

APPLICATIONS FOR LEAVE.

5. Applications for leave will be made on the forms provided, and will be sent to the Principal through the Class Instructor. They must, except when on account of illness or other unforeseen cause, be made at least one day previous to that on which the leave is desired to commence Retrospective leave, save in exceptional cases, will not be granted. It is not enough to submit an application for leave. A student must satisfy himself that his application has been sanctioned. In cases of great emergency Class Instructors will allow students to leave the College in anticipation of sanction. Students on leave will invariably furnish their addresses to the Principal.

ILLNESS.

6. In case of slight indisposition a student will attend College, obtaining casual leave through his Class Instructor if he finds himself unfit for work.

In case of more serious illness, the student will send a post-card to the Principal to the effect that he is under medical treatment. He will, on the production of a certificate from a hospital or from a *qualified* practitioner, be granted leave for such period as the certificate covers. Any period not covered will be treated as absence without leave. The certificate must state that the student was unfit to attend the College, and it must be brought by the student to the College on the first day of his return after absence.

If a student finds himself suffering from an infectious disease (such as small-pox, itch, &c.) he will at once report the fact to his Class Instructor and place himself under medical treatment.

PAYMENT OF FEES.

7. Term fees will be paid to the Librarian on the 15th February and 15th July, or, if either day fall on a holiday, then on the following day. Monthly fees will be paid on the 15th of each month, the fees for January and February being paid together on 15th February, those for April and May on 15th April, and those for June and July on 15th July. Students joining the Engineer, Draftsman, Surveyor and Artisan classes pay fees from January inclusive ; those joining the Engineer Subordinate class pay from July inclusive. In default of punctual payment, a fine of 4 annas per diem for the Engineer class, 3 annas for the Engineer Subordinate class, 2 annas for the Draftsman and Surveyo. classes, and 1 anna for the Artisan class will be exacted from each defaulter until the date of payment. Should the period of non-payment amount to one month, the defaulter will be dismissed the College. Recreation Club fees will be paid with the tuition fees.

NOTE.—The hours for fee payment by the day classes are between 1 P.M. and 3 P.M. on 15th February and 15th July, and between 1 P.M. and 1-30 P.M. on all other occasions.

DEPOSITS.

8. The deposits made by students are intended to cover the cost of essential books and instruments, the latter of which will be supplied to them through the agency of the College. Should any balance ultimately remain at a student's credit, it will be paid to him on his leaving the College, provided he has previously discharged all liabilities. Students may supply themselves with approved instruments or books, but no refund of deposit money will be made on that account. Each student must be in possession of all the books and instruments required for the class division to which he belongs. He must use no note books or field books save those of authorised pattern.

INSTRUMENTS AND DRAWINGS.

9. Each student will be provided with a drawer or locker in which to keep his books, instruments, &c. No plans will be permitted to gain marks unless certified to be the unaided work of the student presenting them. All plans are the property of the College; but specimens will be given to passed students to enable them to afford evidence of their proficiency. Drawing paper and stationery in moderation will be supplied by the College; but if waste takes place, supplies will be stopped. Each student must supply a good lock for his drawer, and should cause his drawing instruments to be engraved with his initials to assist their identification in case of loss.

LIBRARY.

10. The Library, which contains about 3,000 volumes, consists of a Consulting Library and a Lending Library. The Consulting Library, consisting of both books and plans, is open from 9–30 A.M. to 5–30 P.M. on all working days, and from 10 A.M. to 4 P.M. on Saturdays. Works are not to be removed from the Consulting Library. From the Lending Library students of the Engineer class may hold five volumes, those of the Engineer Subordinate class three, and those of the Draftsman or Surveyor class two, so long as deposit balances of Rs. 10, Rs. 6 and Rs. 4, respectively, stand to their credit. Selection of books from the Lending Library may be made daily up to 1–15 P.M. Books should be returned to the Library before 2 P.M. Issues will be made at 4–30 P.M. Books from the Lending Library must not be kept for more than a fortnight. In default of punctual return fine of 1 anna a volume per diem till date of return will be exacted. Books taken out for the vacation will be returned not later than the third working day after the re-opening of the College. Students are prohibited from interchanging books and from applying for books on behalf of other students.

A student taking out a book will bring to the notice of the Librarian any damage it has sustained. Any loss or damage which occurs to a book while in the custody of a student will be at once reported in writing to the Librarian.

A student returning a book will place a slip of paper within it, recording on the slip the number and name of the book, his own name and the date of return. Every student should satisfy himself that the books he has returned to the library are taken off his name in the register, since he is held responsible for the books standing in his name.

certificate signed by a qualified medical practitioner. Punishment for absence without leave will be by fine, by exclusion from the library, by entry in the conduct register, or in aggravated cases by dismissal. Absence without leave will count against the seven (or four) days' leave permissible.

APPLICATIONS FOR LEAVE.

5. Applications for leave will be made on the forms provided, and will be sent to the Principal through the Class Instructor. They must, except when on account of illness or other unforeseen cause, be made at least one day previous to that on which the leave is desired to commence. Retrospective leave, save in exceptional cases, will not be granted. It is not enough to submit an application for leave. A student must satisfy himself that his application has been sanctioned. In cases of great emergency Class Instructors will allow students to leave the College in anticipation of sanction. Students on leave will invariably furnish their addresses to the Principal.

ILLNESS.

6. In case of slight indisposition a student will attend College, obtaining casual leave through his Class Instructor if he finds himself unfit for work.

In case of more serious illness, the student will send a post-card to the Principal to the effect that he is under medical treatment. He will, on the production of a certificate from a hospital or from a *qualified* practitioner, be granted leave for such period as the certificate covers. Any period not covered will be treated as absence without leave. The certificate must state that the student was unfit to attend the College, and it must be brought by the student to the College on the first day of his return after absence.

If a student finds himself suffering from an infectious disease (such as small-pox, itch, &c.) he will at once report the fact to his Class Instructor and place himself under medical treatment.

PAYMENT OF FEES.

7. Term fees will be paid to the Librarian on the 15th February and 15th July, or, if either day fall on a holiday, then on the following day. Monthly fees will be paid on the 15th of each month, the fees for January and February being paid together on 15th February, those for April and May on 15th April, and those for June and July on 15th July. Students joining the Engineer, Draftsman, Surveyor and Artisan classes pay fees from January inclusive; those joining the Engineer Subordinate class pay from July inclusive. In default of punctual payment, a fine of 4 annas per diem for the Engineer class, 3 annas for the Engineer Subordinate class, 2 annas for the Draftsman and Surveyor classes, and 1 anna for the Artisan class will be exacted from each defaulter until the date of payment. Should the period of non-payment amount to one month, the defaulter will be dismissed the College. Recreation Club fees will be paid with the tuition fees.

NOTE.—The hours for fee payment by the day classes are between 1 P.M. and 3 P.M. on 15th February and 15th July, and between 1 P.M. and 1-30 P.M. on all other occasions. The Artisan class will pay fees at 6 P.M.

DEPOSITS.

8. The deposits made by students are intended to cover the cost of essential books and instruments, the latter of which will be supplied to them through the agency of the College. Should any balance ultimately remain at a student's credit, it will be paid to him on his leaving the College, provided he has previously discharged all liabilities. Students may supply themselves with approved instruments or books, but no refund of deposit money will be made on that account. Each student must be in possession of all the books and instruments required for the class division to which he belongs. He must use no note books or field books save those of authorised pattern.

INSTRUMENTS AND DRAWINGS.

9. Each student will be provided with a drawer or locker in which to keep his books, instruments, &c. No plans will be permitted to gain marks unless certified to be the unaided work of the student presenting them. All plans are the property of the College; but specimens will be given to passed students to enable them to afford evidence of their proficiency. Drawing paper and stationery in moderation will be supplied by the College; but if waste takes place, supplies will be stopped. Each student must supply a good lock for his drawer, and should cause his drawing instruments to be engraved with his initials to assist their identification in case of loss.

LIBRARY

10. The Library, which contains about 3,000 volumes, consists of a Consulting Library and a Lending Library. The Consulting Library, consisting of both books and plans, is open from 9–30 A.M. to 5–30 P.M. on all working days, and from 10 A.M. to 4 P.M. on Saturdays. Works are not to be removed from the Consulting Library. From the Lending Library students of the Engineer class may hold five volumes, those of the Engineer Subordinate class three, and those of the Draftsman or Surveyor class two, so long as deposit balances of Rs. 10, Rs. 6 and Rs. 4, respectively, stand to their credit. Selection of books from the Lending Library may be made daily up to 1–15 P.M. Books should be returned to the Library before 2 P.M. Issues will be made at 4–30 P.M. Books from the Lending Library must not be kept for more than a fortnight. In default of punctual return fine of 1 anna a volume per diem till date of return will be exacted. Books taken out for the vacation will be returned not later than the third working day after the re-opening of the College. Students are prohibited from interchanging books and from applying for books on behalf of other students.

A student taking out a book will bring to the notice of the Librarian any damage it has sustained. Any loss or damage which occurs to a book while in the custody of a student will be at once reported in writing to the Librarian.

A student returning a book will place a slip of paper within it, recording on the slip the number and name of the book, his own name and the date of return. Every student should satisfy himself that the books he has returned to the library are taken off his name in the register, since he is held responsible for the books standing in his name.

RECREATION CLUB.

11. The Recreation Club consists of three branches: (1) Cricket, (2) Foot-ball, (3) Reading-room. Every regular student of the College is a member of the club, and will pay a fee of Rs. 2 per term on the 15th February and 15th July in addition to the tuition fees payable on those dates. Casual students desirous of joining the club will apply to the president. A Tennis Club is affiliated to the Recreation Club, and is maintained by separate and additional subscriptions. Membership of the Tennis Club is optional. The reading-room is open from 6 A.M. to 8 P.M.

CHEMICAL LABORATORY.

12. Each laboratory student will provide himself with two dusters and one piece of house flannel. Students will pay for breakages at fixed prices, and are responsible for the cleanliness of their benches. Students whose deposit balance falls below Rs. 5 will be excluded from the laboratory.

WORKSHOPS.

13. Students while in the Workshops are under the orders of the Workshop Instructor. Private work may be done by students with permission, provided they use their own materials. Students will be liable for accidental or other damage to tools. Work must not be taken out of the shops without permission. Trousers and other close-fitting clothes must be worn.

. EXAMINATIONS.

14. During examination, candidates will write their replies to questions *legibly* and *concisely* on one side only of half sheets of paper, leaving the inner quarter margin blank. Each foolscap page will contain at least twenty lines of writing. Students neglecting this rule will have their supply of paper limited. All paper issued to a student will be kept by him on his desk or table. No paper is to be thrown on the floor. No books nor paper of any kind (except tables of logarithms or roots) are to be brought into the room; and no table drawer is to be opened during examination. No student will address any person except the Superintendent and the peon supplying paper. Any candidate detected in either giving or receiving assistance will be at once expelled and his examination will be rendered void. A candidate who leaves the room during examination through illness or otherwise will previously give up his papers and will not be permitted to return. This rule, however, will not be strictly enforced when, from the nature of the examination, the candidate could not possibly receive any assistance during his absence.

VACATIONS.

15. The long vacation commences on 1st May and extends over two months.

The Christmas vacation extends from 23rd December to 17th January.

HOLIDAYS.

16. All Saturdays (except for Workshop classes) and Sundays during the session and the following days:—

Maha Sivarathri	1
Easter	5
Telugu New Year's Day	1
Tamil do.	1
Id Ramazan	1
Avani Avittam	2
Gokula Ashtami	1
Sri Jayanti	1
Moharam	1
Vinayaka Chathurthi	1
Mahalaya Amavasai	1
Dassara	1
Dipavalli	2

CERTIFICATES.

17. The original certificates furnished by a student on admission to the College cannot be returned, nor can any certificate or prize he may have gained be delivered to him, except on the production of a voucher, signed by the Librarian and Storekeeper, that nothing is outstanding against the student in the books of the College. A certificate of conduct and attendance is granted to all students who spend not less than one full term at the College.

EMPLOYMENT.

18. After each certificate examination, lists of qualified candidates are furnished to the Chief Engineer, Public Works Department, and to Superintending Engineers; to the Chief Engineer for Irrigation, the Consulting Engineer for Railways, the Chief Engineers of the Madras and South Indian Railways; to the Presidents of Local Boards and the larger Municipalities; and to other employers. An employment register for passed students is also kept up at the College, and a large number of recommendations is annually made. Students, on leaving the College, must furnish their addresses; and they are strongly recommended in their own interests to communicate, for three years thereafter, every change of address, and every appointment they may secure. It must be distinctly understood that the Principal does not make applications for employment on behalf of individual candidates. He makes recommendations only when applied to by officers requiring the services of passed men.

H. D. LOVE, Major, R.E.,
Principal.

1896.

College of Engineering, Madras.

STANDARD LISTS OF THE INSTRUMENTS AND BOOKS REQUIRED BY STUDENTS OF DIFFERENT CLASSES.

NOTE.—The following instruments are procured for students through the agency of the College, and the cost is charged against deposit accounts. The prices shown are approximate. Books will be procured by the students themselves, the actual cost being refunded from their deposit accounts.

I.—ENGINEER CLASS.

INSTRUMENTS.	RS.	A.	P.
Drawing instruments, half set, double jointed, with protractor and additional drawing pen	16	0	0
Spring bows, in case	9	15	0
Plotting scales, set of three, special pattern	8	12	0
Tee square, 32″	2	0	0
Set squares, 45° and 60°	1	10	0
Drawing pins, half dozen	0	6	0
Crow quills, one dozen	1	6	0
Compass leads, one box	1	4	0
Rule, 2 ft., four-fold	0	10	0
Saucers, nest of six	1	2	0
Brushes, set of three	6	8	0
Colours—Prussian blue, burnt sienna, gamboge, crimson lake, Payne's grey	2	3	0

BOOKS.			
† Rurki Manual VII.—Surveying	3	9	0
College of Engineering Manual—Building Materials and Construction	4	8	0
‡ College of Engineering Manual—Hydraulics	2	8	0
‡ Do. do. Mensuration	1	0	0
Notes and Tables for Engineering Students	0	8	0
Tables of Squares and Cubes	0	8	0
Notes on Practical Chemistry	0	6	0
Steam, Ripper	2	0	0
§ Madras C.E. College Papers, Nos. I and IV, Tamil	4	8	0
§ Madras C.E. College Papers, Nos. II and VII, Telugu	3	8	0
§ Madras C.E. College Papers, No. IX—Estimating	8	0	0
Applied Mechanics, Cotterill and Slade's Lessons	4	0	0
Practical Mechanics, Twisden	7	0	0
Hydrostatics, Besant	2	8	0
Co-ordinate Geometry, C. Smith	5	12	0
Machine Design, Unwin	7	0	0

	RS.	A.	P.
Field Book—Surveying, College pattern	0	7	0
Field Book—Levelling, College pattern	0	8	0
Note Book, College pattern	1	4	0

II.—ENGINEER SUBORDINATE CLASS.

INSTRUMENTS.

Drawing instruments, half set, double jointed, with protractor and additional drawing pen	16	0	0
Plotting scales, set of three, special pattern	8	12	0
Tee square, 32″	2	0	0
Set squares, 45° and 60°	1	10	0
Drawing pins, half dozen	0	6	0
Crow quills, one dozen	1	6	0
Compass leads, one box	1	4	0
Saucers, nest of six	1	2	0
Brushes, set of three	6	8	0
Rule, 2 ft., four-fold	0	10	0
Colours—Prussian blue, burnt sienna, gamboge, crimson lake	1	13	0

BOOKS.

† Rurki Manual VII.—Surveying	3	9	0
College of Engineering Manual—Building Materials and Construction	4	8	0
‡ College of Engineering Manual—Hydraulics	2	8	0
Do. do. Mensuration	1	0	0
Tables of Squares and Cubes	0	8	0
Notes and Tables for Engineering Students	0	8	0
§ Madras C.E. College Papers, Nos. I and IV, Tamil	4	8	0
§ Madras C.E. College Papers, Nos. II and VII, Telugu	3	8	0
§ Madras C.E. College Papers, No. IX, Estimating	8	0	0
Steam, Ripper	2	0	0
Euclid, Todhunter	2	2	0
Elementary Algebra for Schools and Colleges—Hall and Knight	3	6	0
Elementary Trigonometry, Pendlebury	3	6	0
Practical Geometry, Rawle	0	10	0
Statics, Lock	2	12	0
Field Book—Surveying, College pattern	0	7	0
Field Book—Levelling, College pattern	0	8	0
Note Book, College pattern	1	4	0

III.—DRAFTSMAN CLASS.

INSTRUMENTS.

Drawing instruments, half set, double jointed, with protractor, and additional drawing pen	16	0	0
Spring bows, in case	9	15	0
Plotting scales, set of three, special pattern	8	12	0
Tee square, 32″	2	0	0

	RS.	A.	P.
Set squares, 45° and 60°	1	10	0
Drawing pins, half dozen	0	6	0
Crow quills, one dozen	1	6	0
Compass leads, one box	1	4	0
Rule, 2 ft., four-fold	0	10	0
Saucers, nest of six	1	2	0
Brushes, set of three	6	8	0
Colours—Prussian blue, burnt sienna, gamboge, crimson lake, Payne's grey	2	3	0

Books.

	RS.	A.	P.
Linear Drawing and Projection, Cassell	0	3	0
Machine Design, Part I, Unwin	4	8	0
[§] Madras C.E. College Papers, No. IX—Estimating ...	8	0	0
College of Engineering Manual—Building Materials and Construction	4	8	0
College of Engineering Manual—Mensuration ...	1	0	0
Note Book, College pattern	1	4	0

IV.—SURVEYOR CLASS.

[*] Instruments.

	RS.	A.	P.
Drawing instruments, half set, double jointed, with protractor, and additional drawing pen	16	0	0
Plotting scale, 50 × 10, with offset piece	2	8	0
Ditto Ft. $\frac{1}{100,000}$th × Ft. $\frac{1}{50,000}$th . ..	2	8	0
Parallel rule, 18″ rolling	15	0	0
Crow quills, one dozen	1	6	0
Compass leads, one box	1	4	0
Saucers, nest of six	1	2	0
Brushes, set of three	6	8	0
Colours—Prussian blue, burnt sienna, gamboge, burnt umber, crimson lake	2	3	0

Books.

	RS.	A.	P.
[†] Rurki Manual VII—Surveying	3	9	0
Surveying and Levelling, D'Cruz	1	4	0
Field Book—Surveying, College pattern	0	7	0
Field Book—Levelling, College pattern	0	8	0

[*] Drawing instruments are purchased from Stanley, London, and from Messrs. P. Orr & Sons, Madras. The Tee and Set Squares are obtained from the Public Works Workshops.

[†] The Rurki Manual—Surveying, is obtainable from the Thomason College, Rurki.

[‡] Sold at the S.P.C.K. Depository, Vepery, Madras

[§] These papers are sold by Messrs. Higginbotham and Co., Madras.

H. D. LOVE, Major, R.E.,
Principal, College of Engineering.

MADRAS,
1896.

College of Engineering, Madras.

LIST OF MODELS AND APPARATUS FOR USE IN IN-DOOR INSTRUCTION.

When models are to be inspected, the class instructor should, as a rule, take the students into the Model room, where measurements and sketches can be made. Small portable models, instruments, and other apparatus may be obtained from the Model room by indent on the store-keeper. Such apparatus must be invariably returned to the store-keeper on the day of issue.

I.—BUILDING MATERIALS.

Catalogue Number.

13. Building stones used on Madras Railway, 12 samples, of 3½″ cubes, in case.
98. Building stones used on South Indian Railway, 25 samples, of 3½″ cubes, in 3 cases.
14. Limestones, specimens of, in case.
12. Mineralogical specimens, in case.
15. Pugmill. Scale 1″ to 1′.
16. Tile-moulding table. Scale 2″ to 1′.
17. Brick-moulding table. Scale 2″ to 1′.
99. Clayton's brick and tile-making machine. Scale 2″ to 1′.
18. Bricks and tiles, models of. Scale 6″ to 1′.
19. Shell lime kiln, rectangular. Scale 1″ to 1′.
19(*a*). Shell lime kiln, Madras Railway pattern. Scale 1″ to 1′.
20. Sifter, Stoney's. Scale 2″ to 1′.
101. Indian timber, 39 specimens of, each 12″ × 4″ × 4″.
102. Indian timber, 42 specimens of, each 4″ × 3″ × 1″ in case.
342. Sections of rolled iron joists, 4 in number.
343. Sections of bar iron, 27 in number.
344. Specimens of tests of iron, 43 in number.

II.—CARPENTRY.

103. Joints in hardwood, 100 specimens, in case.
21. Scarfed and fished joints, 14 examples.
23. King post truss, strapped, rise one-third span.
24. King post truss, strapped, rise one-sixth span.
25. Truss with 3 verticals, rise one-third span.
22. Trussed beam travelling on gantry. Scale 1″ to 1′.
104. Trussed beam for traveller.
105. Trussed partition. Scale 1½″ to 1′.
26. Venetianed frame.
27. Staircase, dog legged. Scale 2″ to 1′.
28. Stair-case, geometrical. Scale 2″ to 1′.
29. Stair-case, circular. Scale 2″ to 1′.

III.—MASONRY, INCLUDING WALLS, FOUNDATIONS, ARCHING AND CENTRES.

Catalogue
Number.

30. Model bricks, 5 cases.
31. Lewis.
32. Masonry foundations, 3 examples.
33. Coffer dam. Scale 1″ to 1′.
34. Pile driver. Scale 1″ to 1′.
35. Stoney's helical excavator, enlarger and undercutter. Scale 2″ to 1′.
36. Bull's hand dredger. Scale 3″ to 1′.
* 37. Arch ring.
* 38. Arch ring, semi-circular, with 2 doorways, showing flat and relieving arches. Scale 2″ to 1′.
* 39. Skew arch.
40. Centering, solid, clay. Scale 1″ to 1′.
41. Centering, ribbed, semi-circular. Scale 1″ to 1′.
42. Elliptic rib.
43. Centering on temporary pillars. Scale 1″ to 1′.
44. Sand boxes, 4. Scale 6″ to 1′.
45. Wedges, 4. Scale 6″ to 1′.
46. Centre for skew arch, 2 ribs, and 15 pieces lagging.
106. Centre, Best's.

IV.—BUILDINGS, INCLUDING ROOFS.

47. Bungalow, Madras terrace roof, Bengal terrace verandah. Scale 1″ to 3′.
48. Bungalow, trussed roof, terrace verandah. Scale 1″ to 3′.
49. Bungalow, hipped roof. Scale 1″ to 2′.
50. Bungalow, terrace roof. Scale 1″ to 3′.
51. Terrace roof covering. Scale 1″ to 1′.
52. Roof timbering over shed, king post trusses. Scale 1″ to 1′.
53. Roof timbering, Chisholm's trusses. Scale 1″ to 1′.
54. Roof timbering, combination trusses with ventilator, for span of 48 feet. Scale 1″ to 1′.
55. Coupled and hipped roof for store shed.
56. Ventilator roof timbering (trusses not shown). Scale 1″ to 1′.
56(*a*). Iron-roof joints for light 25-feet span, 4 in number. Full size.
56(*b*). Iron-roof joints for 35-feet span, 5 in number. Full size.
100. Iron-roof joints, 7 in number.
107. Double arch, English bond.
108. Elevation of 14″ wall, Flemish bond.
310. Do. do. English bond.

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* These models are executed in masonry.

Catalogue Number.

317. Model of C.I. beam.
318. Do. rolled W.I. beam.
319. Do. built up W.I. beam.

V.—BRIDGES.

57. Spar bridge, single sling.
58. Timber-trussed foot-bridge, struts and straining piece. Scale 1″ to 1′.
59. Timber-trussed bridge, struts and vertical tension rod. Scale 1″ to 1′.
109. Timber-trussed bridge, 2 vertical tension rods. Scale 1″ to 1′.
60. Timber lattice bridge, iron trussing. Scale 2″ to 3′.
110. Timber lattice bridge. Scale 1″ to 1′.
61. Masonry bridge, segmental arches, straight wings. Scale 1″ to 3′.
62. Do. do. do. do.
63. Masonry bridge, elliptic arches, sectional model. Scale 1″ to 5′.
64. Masonry bridge, skew arches. Scale 1″ to 2′.
* 65. Bridge pier, face wall, spandril filling, dentil cornice, perforated parapet.
66. Iron plate girder railway bridge of 30 feet span. Scale 1″ to 1′.
291. Iron girder railway bridge of 140′ span over Pennér, double system of bracing, iron cylinder foundations. Scale 1″ to 4′.
67 Equlibrium draw-bridge.
111. Suspension bridge joints, 3 in number.
82. Road culvert. Scale 1″ to 1′.
83. Railway culvert. Scale 1″ to 2′.
292. Abutment, showing skew-back and cut-water.

VI.—IRRIGATION WORKS.

68. Kistna anicut and head works. Scale 1″ to 40′.
70. Regulating dam, with bridge of 30 arches, and 4 sets of sluices. Scale 1″ to 10′.
71. Anicut and lock (Sadikuppam, Buckingham canal). Scale 1″ to 2′.
72. Head sluice of 2 vents. Scale 1″ to 4′.
73. Head sluice of 3 vents. Scale 1″ to 4′.
74. Head sluice of Central Delta, Gódávari. Scale 1″ to 2′.
75. One vent of Central Delta, enlarged, with shutters and gearing. Scale 1″ to 1′.
76. Sluice vent with revolving shutter. Scale 3″ to 2′.
77. Lock. Scale 1″ to 2′.
78. Tank sluice, 1 plug. Scale 1″ to 1′.
79. Tank sluice, 6 plugs. Scale 1″ to 2′.
69 Tank sluice, with screw shutter.

Catalogue
Number.

80. Tank escape, with dam stones. Scale 1″ to 1′.
81. Siphon sluice. Scale 2″ to 3′.
80(*a*). Small tank escape. Scale 1″ to 2′.
113. Large tank escape (Nellore tank). Scale 1″ to 2′.

VII.—DRAWING INSTRUMENTS AND APPARATUS.

114. Drawing instruments, cases of.
115. Parallel rules, 12″ to 24″.
116. Straight edges, 36″ to 42″.
117. Tee squares, 32″, 42″ and 54″.
118. Set squares, 45° and 60°.
119. Stencil plates for alphabets.
120. Drawing boards.
121. Curves, French.
122. Railvay curves, cardboard, radius 1½″ to 120″, set of 50 in case.
123. Protractors, ivory, 6″, 8″ and 12″.
124. Protractors, ivory, Aldershot, with scale of shade.
125. Protractors, boxwood, with scale of shade.
126. Protractors, circular, 12″ divided on silver to 20 minutes.
127. Protractors, circular, 6″, 9″, and 12″, cardboard.
128. Beam compass.
129. Drawing compass, Brooks'.
130. Triangular compass.
131. Compass for black board, 24″.
132. Ellipsograph.
133. Pantagraph.
134. Eidograph.
135. Centrolineads.
136. Marquois scales.
137. Plotting scales, decimally divided.
138. Plotting scales, Architects' or Engineers'.
139. Scales, cardboard, Holtzapfel's for machine drawing.
140. Spring bows.
112. Topographical model of contoured ground.
1. (i) Geometrical solids (for mensuration), comprising—*Cylinder* oblique and right ; *sphere* and segment ; *circular ring* ; *pyramid*, triangular ; *pyramid*, regular pentagonal, and frustum ; *pyramid*, irregular pentagonal, forming three triangular pyramids ; *cone* and frustum ; *parallelopiped* oblique ; *prisms*, triangular ; *prism*, triangular, forming three equal pyramids ; *prism*, right triangular, forming wedge ; *prism*, quadrilateral, oblique or right ; *prism*, hexagonal.
   (ii) Regular solids, consisting of *tetrahedron*, *cube*, *octahedron*, *dodecahedron*, *icosahedron*.
   (iii) Geomerrical solids (for model-drawing), consisting of *sphere*, *skeleton cube*, *solid crosss*, *square pyramid*, *ring*, *cone*, *octagonal prism*, *solid cube*.

Catalogue
Number.

295. Cone, showing conic sections.
311. Models for orthographic projection, set of six.
312. Do. do. set of four.
307. Contoured models of hilly ground, set of six.

INSTRUMENTS.*

141. Chains, 50′, 66′ and 100′.
142. Tapes, 100′.
143. Perambulator.
144. Plane table.
145. Plane table, S.M.E. pattern.
146. Clinometer rule.
147. Clinometer, for ghat tracing.
148. Clinometer, De Lisle's.
149. Quadrant, Gunner's.
150. Quadrant, for ghat tracing.
151. Prismatic compass.
152. Surveying compass.
153. Sextant, Box.
154. Sextant, astronomical, with artificial horizon.
155. Optical square, 2″.
156. Circumferenter.
157. Angle meter.
158. Reflecting semi-circle.
159. Acre combs, 8″ and 16″ to 1 mile.
160. Computing scales, Stanley's, 4″, 8″, and 16″ to 1 mile.
161. Theodolite, Everest's double arc, 5″ to 7″.
162. Theodolite, common, 6″.
163. Theodolite, transit, 5″.
164. Theodolite, transit, 6″ with lantern, and fitted with Dalrymple-Hay's curve ranger.
165. Level, Troughton's.
166. Level, Y.
167. Level, Dumpy.
169. Level, reversible.
170. Abney's level.
198. Water-level, French.
199. Levelling staves.
308. Level, field service.
200. Cross staff.
201. Offset rods.
309. Boning rods, set of three.
202. Surveying poles.
323. Telemeter, Labbez'.

IX.—MEASURING INSTRUMENTS.

203. Planimeter, Amsler's, for measuring plane areas.
306. Planimeter, Hohmann Coradi's precision.

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* Instruments used for out-door instruction, such as chains, prismatic compasses, levels, theodolites, &c., are not required to be returned daily into store.

Catalogue
Number.

204. Integrator, Amsler-Laffon, with 5′ steel guide, for areas, centres of gravity, and moments of inertia (with pamphlet).
205. Measuring instrument, Morris', rolling.
206. Vernier, large size, in wood.
207. Verniers on circular arc.
208. Measure, steel, 20′, for testing survey chains.
209. Rules, 2′, fourfold.
210. Slide rule, Fuller's cylindrical, calculating (with pamphlet).
211. Spherometer, measuring to ·0001″.
212. Standard gauge, electrum, measuring to ·001″.
213. Wire gauge, measuring to ·001″.
214. Calculating scales, Gunga Ram's, for roofs, bridges, and retaining walls, 3 in number (with pamphlet).
215. Cement-testing apparatus, Michaele's double lever, to test to 1,000 lb. per square inch, consisting of—

	NO.
Machine, with zinc shot bucket	1
Spring balance to show breaking strain ...	1
Automatic shot run	1
Brass moulds (section of briquette 1″ × 1″) ...	6
Brass sieve box, 625 meshes to the square inch.	1
Brass sieve box, 5,800 meshes to the square inch.	1

320. Torsional testing machine, Thurston's.
321. Wire tester, Bailey's.
338. Speed indicator in case, Young's.

X.—MECHANICS.

3. Parallelogram of forces.
4. Lever, 4′, with weights.
216. Centre of gravity board.
217. Wheel and axle.
218 Train of toothed wheels.
219. Capstan.
220. Windlass.
221. Forge or tilt hammer.
5. Pulleys, 3 systems.
222. Concentric pulleys, White's.
6. Inclined plane, adjusting, brass surface.
7. Inclined plane, adjusting, teak surface.
223. Screw.
8. Screw jack. Scale 3″ to 1′.
224. Hydraulic jack, Tangye's, for 3 tons.
9. *Mechanical powers.*—Professor Willis' apparatus in case, illustrating composition and resolution of forces; resultant of parallel forces; principle of moments; levers, simple and compound; wheel and axle; inclined plane; wedge; screw.

Catalogue
Number.

10. Sheers, Triangle and Derrick, apparatus to illustrate, with cardboard diagrams of stresses, in case.
168. Attwood's machine, with pulleys, weights and pendulum.
84. Testing machine, for tension and compression.
85. Testing machine, for deflexion.
86. Vertical shearing stress in beams, apparatus to show—
325. Apparatus for measuring centrifugal force.
326. Apparatus for measuring the efficiency of screws.
297. Apparatus for determining moment of inertia of a heavy wheel.
339. Apparatus for determining the laws of torsion.
340. Apparatus for determining the coefficient of friction.
341. Apparatus for determining the efficiency of toothed gearing.
301. Gyroscope.
313. Cycloidal pendulum.
225. *Natural philosophy, large built up apparatus for lecturers and experimenters in, comprising—

	NO.
Adapters	2
Balances, spring, 25 to 500lb.	8
Balances, spring, $\frac{1}{4}$ to 15lb.	2
Balances, spring, $\frac{1}{4}$ to 20lb.	2
Bars, graduated, iron, 5$\frac{1}{2}$′ and 6′ long	2
Bars, graduated, wood, 4′ long	1
Beds, slotted, deal, from 2′ to 9′ in length	13
Bell, shutter	1
Blocks, single sheave	5
Blocks, two sheave	4
Blocks, three sheave	2
Blocks, four sheave	2
Block, epicycloidal, Eade's, to carry 10 cwt.	1
Block, Weston's differential pulley, 10 cwt.	1
Block, sole	1
Boss, turned, wrought iron	2
Board, base	1
Bolts, coach, $\frac{3}{8}$″ with thumbscrew and plate washer, from 4$\frac{3}{4}$″ to 8$\frac{1}{4}$″ in length	26
Bolts, $\frac{3}{4}$″ with hexagonal nuts, from 2$\frac{3}{4}$″ to 3$\frac{1}{2}$″ in length	8
Bolts, bent hook, $\frac{3}{8}$″, 8″ in length	3
Bolts, $\frac{3}{8}$″ (assorted lengths)	12
Bolt, eye	2
Brackets, C.I. slotted, with $\frac{5}{8}$″ hole and binding screw, various patterns	25
Chain, crane, $\frac{3}{16}$″, length 15′	1
Chain, crane, $\frac{3}{16}$,″ length 60′	1

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* This apparatus is described in Willis' *Apparatus for Lecturers and Experimenters in Natural Philosophy*—Weale; and applications of it will be found in Ball's *Experimental Mechanics*. Macmillan.

	NO.
Chain, crane, 3/16″, length 15′	1
Chain. crane, 5/16″, length 60′	1
Chain, 8′ 4″ in length	1
Collar, 1″, loose, turned	2
Coupler, brass	1
Cramps, 3″ to 6″	14
Disc, iron, 18″ diameter	1
Drum, flanged, 4½″	2
Fly wheel, 18″ diameter	1
Frame, single	1
Frame, side	2
Handles	2
Jack, screw, for 2 tons	1
Knife edge, with 2 hexagonal nuts	3
Lengthener, brass	1
Hoops, angle	9
Hoops, straight	7
Pedestals, with brass steps	4
Pine, pieces	5
Pulley, 5″ fixed	1
Pulley, wood	1
Pulley, brass	1
Pulleys, clamp, wood	2
Pulley bearing, adjustable W.I. slotted	1
Rectangles, C.I. slotted, 6″ × 9″	5
Screw, tension wood, with block	1
Screw, W.I. square thread, 1¼″ diameter	1
Shaft ring, W.I.	3
Shafts, turned, 12″, 18″, 24″	3
Shafts, ¾″, length 1′ to 3′ with carriage	3
Sockets and nuts, brass reducing	2
Sockets, brass	2
Socket, C.I. and brass nut, with set screw	2
Socket, double, C.I., and two brass nuts	2
Spanners	6
Spindles, with brass pulley and thumb screw	2
Spindles, with hexagonal nuts	2
Spur wheels, 20, 21, 24, 25, 30, 40, 60, 100, 120 teeth	9
Strainer, wire, 8¼″ with fly nuts	1
Studs and nuts, W I.	5
Stud and nut, reducing, W.I.	2
Stud for lever	4
Table, slit, wood	1
Tables, stand, 2½′ × 2½′ × 1¾′	3
Tube fittings, brass, ¾″ with shaft rings and binding screws	8
Tube fittings, special	2
Washers, split pins, S hooks, nuts, ¼″ rope	
Weights, iron, viz., 8 of 56lb, 6 of 28lb, 3 of 14lb, 3 of 7lb, 1 of 6lb, 1 of 5lb, 2 of 4lb, 1 of 3lb, 2 of 2lb, 2 of 1lb.	29

	NO.
Weight, lead, 3·1℔	1
Weights, set of, ¼℔ to 14℔	7
Wheel, grooved, carrying pinion of 20 teeth ...	1
Winch	1
Wrench	1

XI.—HYDROMECHANICS.

Catalogue
Number.

171. Water pressure, apparatus to illustrate.
172. Flotation apparatus.
173. Specific gravity bottle.
174. Hydrometer, Sykes'.
175. Hydrometer, Nicholson's.
176. Hydrometer, universal.
177 Hydrometer, common.
178. Siphon, glass.
179. Lift pump, glass.
180. Force pump, glass.
111. Lift pump, sectional working model.
181. Hydrostatic bellows, 12″.
182. Boyle's law, apparatus to illustrate.
183. Air-pump, oscillating, double acting.
184. Water-wheels, overshot and undershot, small workin models with tank.
185. Water-wheel, overshot. Scale 1″ to 1′.
186. Water-wheel, breast. Scale 1″ to 1′.
187. Scoop wheel. Scale 1″ to 1′.
188. Chain pump and windmill.
189. Centrifugal pump Gwynne's
190. Turbine, inward flow.
191. Current meter
322. Electric current meter, Harlacher's.
345. Turbine, 8½″ diameter with regulating sluice.

XII.—MECHANISM AND MACHINE CONSTRUCTION.

87. Steam engine, horizontal, with governor.
88. Boiler for do. do.
89. Steam engine, horizontal.
192. Steam engine, horizontal, portable, with boiler.
90. Steam engine, vertical, oscillating cylinder.
91. Steam engine, beam.
92. Steam engine, sectional working model.
93. Link motion and reversing gear.
94. Pump, oscillating cylinder.
95. Mortising machine.
96. Quick return motion, Whitworth's.
97. Shifting slides and cams.
193. Winnowing machine.
194. Winnowing machine, sectional model.
195. Screw press for cotton.

Catalogue
Number.

196. Punkah wheel, Stoney's self-lubricating.

197. Kinematic models of Professor Reuleaux, comprising—

(A). *Lower Pairs of Elements.*

1. Twisting or screw pair.
2. Turning or cylinder pair.
3. Sliding or prism pair.

(B). *Higher Pairs of Elements.*

1 Equilateral duangle in triangle.
2. Equilateral curve triangle in square.
3 Equilateral curve triangle in rhombus.
4. Isosceles curve triangle in square.

(C). *Simple Kinematic Chains and mechanisms.*

1. Quadric cylinder crank chain.
2. Slider crank chain.
3. Quadric conic crank chain.
4. Reduced slider crank chain.
5. Do. do.
6. Reduced conic crank chain.
7. Simple spur-wheel chain with annular wheel.
8 Simple spur-wheel chain.
9. Endless screw.

(D). *Crank Trains.*

1. Slider cranks.
2. Swinging block (slider crank).
3. Turning block (slider crank).
4 Swinging slider crank.
5. Double crank (drag-link coupling with reduced centroids).
6. Turning block (slider crank) with reduced centroids.
7. Double slider crank with curved side
8. Double slider crank.
9. Turning block (slider crank).
10. Elliptic chuck.
11. Swinging slider crank.
12. Swinging slider crank (ellipsograph).
13. Swinging skew double slider.
14. Quadric crank chain with slot and sector.

(E) *Crank Trains with Expansion.*

1 Slider crank with pin expansion, 2 within 1.
2. Do. do. do. 1 ,, 2.
3. Do do. do. 3 ,, 2.
4. Do do. do. 2 ,, 3.
5 Do. do. do. 2 ,, 3, annular expansion.

6. Slider crank with pin expansion, 1 within 2 within 3.
7. Do. do. do. 3 „ 2 „ 1.

(F) *Chamber Crank Gear adapted for Inversion.*

1. Chamber crank gear, Simpson and Shipton.
2. Chamber crank gear, Cochrane.
3. Chamber crank gear, Beale.
4. Chamber crank gear, Ramelli.
5. Chamber crank gear, Wedding.
6. Chamber crank gear, Davies.

(G). *Toothed-wheel Train adapted for Inversion.*

1. Returning spur-wheel trains a = 20, b = 21, c = 30, d = 31, with 6 exchangeable, gives 10 mechanisms.
2. Returning spur-wheel train with annular wheel, &c.
3. Do. do. do.
4. Do. do. do. 2 annular wheels.
5. Do. do. do.
6. Do. do. with intermediate wheel.
7. Do. do. do.

(H). *Subsidiary Apparatus.*

1. Stand for carrying the above models when in use.
2. Same as No. 1, otherwise arranged.

Catalogue
Number

226. Indicator, Richard's, with Darke's parallel motion.
227. Lap and butt joints.
228. Lap joint, single riveted.
229. Butt joint, single riveted.
230. Lap joint, double riveted.
231. Three plates, riveted.
232. Four plates, riveted.
233. Two plates and angle.
234. Tee joint.
235. Four cast plates.
236 Junction of cast plates.
237. Knuckle joint.
238. Keys.
239. Cotters.
240. Gib and cotters.
241. Hydraulic joint.
242. Crank shaft.
243. Flange coupling.
244. Disengaging clutch.
245. Strap connecting rod end.
246. Box connecting rod end.
247. Forked connecting rod end.
248. Coupling rod joint.
249. Piston.

Catalogue
Number
250. Cylinder cover.
251. Slide valve.
277. Axle-box, railway carriage—
278. Spur wheel.
279. Pinion.
280. Bevel wheels, two in number.
281. Ratchet wheel.
282. Belt pulley.
233. Plummer block.
284. Connecting rod end.
285. Connecting rod end, small.
286. Eccentric rod end.
287. Safety valve, with weight.
288. Crosshead of valve spindle.
289. Pipe elbow.
290. Water valve.
296. Rail, chair, and key.
329. Boiler punch.
330. Cam.
331. Screw returning into itself.
332. Hoop and pin wheel.
333. Hooke's joint.
334. Twelve forms of iron bolt.
335. Wall plate and bracket.
336. Hanger pedestal.
337. Solid bottom tap.
314. Eccentric.
315. Slide bars and crosshead.
316. Lift or puppet valve.

NOTE.—*Numbers* 277 *to* 290 *are full-size specimens.*

XIII.—METEOROLOGICAL INSTRUMENTS.

298. Anemometer, Biram's colliery.
252. Barometer, Mountain.
253. Barometer, Aneroid.
254. Barometer, Aneroid, with autographic record.
299. Barometer, Standard, Fortin's.
255. Rain gauge.
256. Rain guage, Howard's.
257. Thermometers, standard maximum and minimum, and Mason's hygrometer.
258. Cup anemometer Robinson's.

XIV.—PHOTOGRAPHIC APPARATUS.

		NO.
259.	Cameras	5
260.	Camera stands	2
261.	Lenses, landscape and portrait	5
262.	Scales and weights, sets of	2

Catalogue Number.		NO.
263.	Argentometer	1
264.	Printing frames, set of	1

XV.—MISCELLANEOUS.

2. Binomial square and cube.
265. Spirit level.
266. Telescope, 1½″ object glass.
267. Telescope, astronomical, 3″ object glass.
268. Mariner's compass.
269. Optical lantern, with 25 large and 20 small slides.
270. Sun-dial.
271. Compound bar of iron and brass to illustrate inequality of expansion.
272. Copying press.
273. Microscope.
274. Spectroscope, Bunsen and Kirchoff.
275. Field glasses, binocular.
276. Oil stone.
302. Thermopile.
303. Galvanometer.
304. Tuning forks and resonance boxes.
324. Armillary sphere, Slater's.
327. Le Clanché's battery (12 cells)
328. Grove's battery (6 cells).

H. D. LOVE, Major, R.E.,

1896. *Principal, College of Engineering.*

LIST OF DRAWINGS.

FOR USE IN CLASS INSTRUCTION

[*Obtainable from the Storekeeper on requisition*]

General Title	Title of Drawing	No. of Shelf.
Machine Details.—Unwin's Examples	1	No. 1, Left
	2 Rivets and riveted joints	
	3. Bolts, nuts, stays, &c	
	4 Pedestal and wall-plate	
	5 Shaft couplings	
	6. Pullies	
	7.	
	8 Cranks	
	9 Eccentric for a locomotive	
	10. Cross-heads and slides	
	11 Connecting-rod	
	12 Connecting-rod ends	
	13 Pistons	
	14 Cylinder cover and stuffing box	
	15. India-rubber valves	
	16 Cocks	
Machine Drawing.—Busbridge's Examples	1 Design for a governor	Nos. 2, 3 and 4, Left.
	2 Hanging bracket and pillow block for a 3½-inch shaft attached to a 16-inch cast-iron girder	
	3 Connecting-rod end for a 25 horse-power engine	
	4 Movable head-stock for a lathe	
	5. Stop cock for steam or water	
	6. Mitre wheel	
	7 Pillow block, plummer block or pedestal for a 4½-inch shaft or journal.	
	8. Do. do. do. sheet 2	
	9. Water-cock or tap	
	10. Sheave or pulley for a crane	
	11. Steam whistle	
	12 Cast-iron crank	
	13. Cast-iron fly-wheel, 8 ft diam	
	14. Spur wheel	
	15. Projection of a V-thread screw and nut.	
	16. Projection of a square thread screw and nut	
	17 Engineer's vice	
	18 Design for engineer's parallel vice	
	19 Shifting wrench	

LIST OF DRAWINGS—*continued*.

General Title.	Title of Drawing.	No. of Shelf.
Machine Drawing. — Busbridge's Examples—*cont.*	20. Gresham's injector	Nos. 2, 3 and 4, Left.
	21. Cylinder cover with stuffing-box	
	22. Head of piston rod	
	23 Shaft couplings	
	24. Safety valve	
	25. Hydraulic lifting-jack to raise 10 tons.	
	26. Wall box and bearing for 4-inch shafting.	
	27. Flange coupling for 6-inch shafting	
	28. Six-inch stop, shut off or junction valve.	
	29. Adjustable hanger for line shafting	
	30. Feed valve for marine boiler	
	31. Sliding expansion joint for steam pipes.	
	32. Friction clutch for mill gearing	
	33. Kingston valve	
	34. Stuffing boxes for engine cylinders.	
	35. Wall bracket for line-shafting	
	36. 3½-inch feed pump	
	37. Air pump bucket and delivery valve.	
	38. Section of a 12-inch double-acting lift and force pump.	
	39. 12-inch double-acting lift and force pump.	
	40. Land engine piston	
	41. Marine engine piston	
	42. Eight-inch sluice valve	
	43. Spur segment fly-wheel and mortice pinion.	
	44. Riveted joints	
	45. Riveted joints, connection of plates with angle iron.	
	46. Various forms of bolts and nuts	
	47. Counter-shaft for slow-feed and quick-return motion	
	48. Section of mitre wheels and foot-step.	
	49. Steam engine cylinder for horizontal engine.	
	50. Link motion for a locomotive	
	51. Sixteen-inch lathe head, poppet head or movable head stock.	
	52. Sixteen-inch double-geared lathe head or fast head stock.	
	53. Gwynne's centrifugal pump	
	54. Warner's hydrant post	
	55. Pulley blocks	

LIST OF DRAWINGS—*continued*.

General Title.	Title of Drawing.	No. of Shelf.
Machine Drawing. — Busbridge's Examples—*cont.*	56. Knuckle joint	Nos. 2, 3 and 4, Left.
	57. Forelink of Watt's parallel motion	
	58. Projection of spiral spring	
	59. Slotted lever link for feed motion of shaping machine.	
	60. Curved arm rigger, drum or pulley.	
Applied Mechanics.—Set of drawings from Imperial College of Engineering, Tokio, Japan.	1. Graphical solution for plane sets of forces.	No. 5, Left.
	2. Theorems in graphical statics ..	
	3. Stress diagrams for roof-trusses ..	
	4. Bending moment and shearing force diagrams for simple loads.	
	5. B.M. and S.F. diagrams for any fixed loads.	
	6 Method of sections; B.M. and S.F. diagrams for framed structures, counterbraced.	
	7. Comparison of the methods of superposition, sections and reciprocal figures.	
	8. B.M. and S.F diagrams for moving loads.	
	9 Trussed beam for rolling load ..	
	10. Forms of beams of uniform strength.	
	11. Moment of inertia of a cross section, graphically.	
	12. Moment of inertia of quadrant of a circle, graphically	
	13 Distribution of shearing stress in a cross section. Size and pitch of rivets for a built beam.	
	14. Ellipse of stress for retaining walls.	
	15. Line of stress in buttresses ..	
	16. Stability of segmental arch ..	
	17 Stability of elliptic arch	
	18. Angle of rupture in circular arch ..	
	19. Angle of rupture in elliptic arch ..	
Bridges.—Set of drawings from Imperial College of Engineering, Tokio, Japan.	1. Approaches to road bridge ..	No. 6, Left.
	2. Masonry railway bridge, semi-circular arches.	
	3. Cast-iron bridge	
	4. Latice-girder railway bridge ..	
	5. Trussed roof for railway station ..	
	6. Design for railway platform ..	
	7. Railway tunnel	
	8. Iron road bridge	
	9. Details for do.	
	10. Approximate transformed catenary, one centre.	

LIST OF DRAWINGS—*continued.*

General Title.	Title of Drawing.	No. of Shelf.
Bridges.—Set of drawings from Imperial College of Engineering, Tokio, Japan—*cont.*	11. Wrought-iron braced arch, hinged at crown and abutments.	No. 6, Left.
	12. Girder bridge, 56 feet span	
	13. Plate girder bridge	
	14. Railway viaduct	
	15. Masonry railway bridge	
	16. Masonry bridge	
	17. Railway tunnel	
	18. Masonry lock	
Bridges.—Set of drawings of Railway bridge from Imperial College of Engineering, Tokio, Japan.	1. General drawing of proposed viaduct.	No. 7, Left.
	2. Details of bowstring girder	
	3. Piers, cast-iron and stone	
	4. Elevation of bowstring girder	
	5. Abutments	
Bridges.—South Indian Railway.	1. Braced girders of 120 feet span. Details of rail bearers (2 copies).	No. 8, Left.
	2. Braced girders of 120 feet span. Details of main girder (2 copies).	
	3. Girders for Karunguli bridge	
Bridges.—Roadway.	1. Iron bridges for first-class roads, 5 feet clear span.	No. 9, Left.
	2. Iron bridges for second-class roads.	
	3. Iron bridges for first-class roads, 7½ feet clear span.	
	4. Iron bridges for second-class roads.	
	5. Iron bridges for first-class roads, 10 feet clear span.	
	6. Iron bridges for second-class roads.	
	7. Iron bridges for first-class roads, 15 feet clear span.	
	8. Iron bridges for second-class roads.	
	9. Iron bridges for first-class for 20 feet span.	
	10. Iron bridges for second-class for 20 feet span.	
	11. Iron bridges for first-class, 25 feet span.	
	12. Iron bridges for second-class for 25 feet span.	
	13. Iron bridges for first-class, 30 feet span.	
	14. Iron bridges for second-class for 30 feet span.	
	15. W.I. pony-truss with pin connections or first-class roads, 40 feet span centres of bearings.	

LIST OF DRAWINGS—*continued*

General Title.	Title of Drawing.	No. of Shelf.
Bridges.—Road-way—*cont.*	16. W.I. pony-truss with pin connections for first-class roads, 50 feet span centres of bearings.	No. 9, Left.
	17. W.I. pony-truss with pin connections for first-class roads, 60 feet span centres of bearings.	
	18. W.I. pony-truss with pin connections for first-class roads, 70 feet span centres of bearings.	
	19. W.I. pony-truss with pin connections for first-class roads, 80 feet span centres of bearings.	
	20. Steel through bridge with pin connections for first-class roads, 95 feet span centres of bearings.	
	21. Steel through bridge with pin connections for first-class roads, 114 feet span centres of bearings.	
	22. Steel through bridge with pin connections for first-class roads, 138 feet span centres of bearings.	
	23. Steel through bridge with pin connections for first-class roads, 152 feet span centres of bearings.	
Bridge over the Vaigai at Madura.	1 General plan	No. 10, Left.
	2. Details of centre and parapet	
	3. Details of parapet	
Forth Bridge.	1. Queensferry main pier	No. 11, Left.
	2. Fife main pier	
	3. Crossing of tie and strut in first bay of cantilever.	
	4. Erection of first bay of the northern or Fife cantilever.	
	5. Queensferry main pier	
	6. View from south shore and Fife main pier.	
	7. Inchgarvie main pier	
	8. H.M.S. *Devastation* passing the Fife pier.	
	9. The Forth bridge piers	
	10. View looking through the steel-work over the south main pier at the level of the railway.	
	11. Top member over Inchgarvie pier	
	12. Railway girders over Queensferry pier.	
	13. Pier of Forth bridge	

LIST OF DRAWINGS—*continued.*

General Title.	Title of Drawing.	No. of Shelf.
Bridges.—Iron.	1. Bridge over the river Thames at Putney.	No. 12, Left.
	2. Bridge over the river Thames at Putney.—Details of construction.	
	3. Steel Cantilever Railway bridge over the St. John's river N.B., Canada.	
	4. Do. do. plate 2.	
	5. Do. do. plate 3.	
	6. Double road bridge over the river Douro.	
	7. Do. do. plate 2.	
	8. Do. do. plate 3.	
	9 The Hawkesbury river bridge, New South Wales.	
	10. Do. do. plate 2.	
	11. Bridge over the Ibicay river; Great Southern Railway, Brazil.	
	12. The Bagain river bridge; Indian Midland Railway.	
	13. The Blair crossing bridge, U.S.A.	
	14. Do. do. plate 2.	
	15. Do. do. plate 3.	
	16. Lifting bridge at Tarante, Italy ..	
	17. Do. do. plate 2.	
	18. Foot bridge over the river Oker at Brunswick.	
	19. Do. do. plate 2.	
	20. The temporary erection of the Sakkar Cantilever bridge.	
	21. Sakkar bridge.—Description of ..	
	22. Bridge over the Lawrence river at Lachine; Canadian-Pacific Railway.	
	23. American bridge failures	
	24. Do. do. plate 2 ..	
	25. Do. do. plate 3 ..	
	26. Do. do. plate 4 ..	
	27. Do. do. plate 5 ..	
	28. Do. do. plate 6 ..	
Irrigation Works—Standard Designs, P.W.D.	1.	No. 13, Left.
	2. Road tunnel and head sluice ..	
	3. Karanguli sluice, Viranam tank ..	
	4. Surplus weir	
	5. Cheap surplus weir	
	6. Fall, Muparru channel, Kistna, E.D.	
	7.	
	8.	
	9.	
	10. Girder bridge, Velpur canal, Gódávari, W.D.	

LIST OF DRAWINGS—*continued.*

General Title.	Title of Drawing.	No. of Shelf.
Irrigation Works—Standard Designs, P W.D.—*cont.*	11. Disposition of materials at a lock site.	No. 13, Left.
	12. Disposition of materials at a lock site.	
	13. Aqueduct, Ellore canal	
	14. Syphon culvert	
	15. Syphon aqueduct	
	16. Aqueduct	
	17. Lock gates for second-class lock ..	
	18. Sections of Iyar, left bank	
	19. Shutters and screw-gearing for head-sluice.	
	20. Surplus weir, Chembrambakam tank	
	21. Surplus weir, Nellore tank ..	
	22. Tank irrigation sluice	
	23. Shutters and gearing for do. ..	
Sluice Gates, Gearing, &c.—Faulkner's Designs (4 sets).	1. Lock gate, balanced valve ..	Nos. 14, 15, 16 and 17, Left.
	2. Upper gates, Kendrapara canal ..	
	3 Lock gates, lifting gear	
	4. Equilibrium culvert valve ..	
	5. Equilibrium culvert valve	
	6. Faulkner's 'ek dum' valve ..	
	7 Bridge over tail bay of lock ..	
	8. Bridge for Nuddea irrigation works.	
	9. Bridge over high level canal ..	
	10. Design for bridge 60-feet span ..	
	11. Bridge over tail bay of lock ..	
	12 Bridge over escape	
	13 Telescope bridge over lock chamber.	
	14 Double shutters	
	15. Under-sluice shutters	
	16. Shutter gear	
	17. Details of double shutters	
	18. Details of double shutters	
Irrigation Works, Godavari Delta System.	1. Sketch map	No. 18, Left.
	2. Head lock, Dowlaishweram ..	
	3. Gearing for head lock, Dowlaishweram.	
	4 Head-sluice shutters, main canal ..	
	5 Under-sluice, Dowlaishweram ..	
	6 Head-sluice, main canal, Bobberlanka.	
	7. Lock, Bobberlanka	
	8. Lock, Vijeswaram	
	9. Head-sluice, Vijeswaram	
	10. Under-sluices, Vijeswaram ..	
	11. Under-sluices, Bobberlanka ..	
	12. Map of delta	
	13. Plan of anicut	
	14. Anicut, head and under sluices ..	
	15. Double lock, Purimillu	

LIST OF DRAWINGS—*continued.*

General Title.	Title of Drawing.	No. of Shelf.
Irrigation Works, Godavari Delta System—*cont.*	16. Lock, Mukamala	No. 18, Left.
	17. Escape weir, Chettipett	
	18. Gunnaram aqueduct	
	19. Dowlaishweram under-sluices	
	20. Shutters and gearing under-sluices.	
Irrigation Works, Kistna Delta System.	1. Sketch map	No. 19, Left.
	2. Anicut	
	3. Head-sluice, main canal, Bezwada	
	4. Shutters and screw-gearing to do.	
	5. Under-sluices at Bezwada	
	6. Details of shutters to do.	
	7. Lock at Bezwada	
	8. Bridge over main canal	
	9. Head sluice, main canal, Sitanágaram.	
	10. Under-sluices, Sitanágaram	
	11. Map of delta	
	12. Kistna anicut	
Irrigation Works, Penner Delta System.	1. Sketch map	No. 20, Left.
	2. Anicut	
	3. North under-sluice	
	4. Auxiliary head-sluice	
Irrigation Works, Cauvery Delta System.	1. Sketch map	No. 21, Left.
	2 Upper Coleroon anicut	
	3. Grand anicut	
	4. Cauvery dam and Upper Coleroon anicut.	
	5 Diagram of rise and fall of river	
	6. Regulating dam at Srírangam	
	7. Grand anicut, and Cauvery and Vennár regulators.	
	8. Cauvery and Vennár regulators	
	9. Iron falling shutter, Grand anicut	
	10. Details of falling shutter, Grand anicut.	
	11. Details of Cauvery and Vennár regulators.	
	12. Details of shutters, Cauvery regulator.	
	13. Iron falling shutter, Grand anicut	
	14. Details of shutters, Vennár regulator	
	15. Covilada kalingula	
	16. Map of delta	
	17. Upper Coleroon anicut	
	18. Cauvery regulator, Srírangam	
	19. Lower Coleroon anicut	
	20. Cauvery and Vennár regulator	
	21. Grand anicut, Tanjore, with bridge and under-sluices.	

LIST OF DRAWINGS—*continued.*

General Title.	Title of Drawing.	No. of Shelf.
Irrigation Works, Tank Systems.	1. Cheyáru anicut system, group map ..	No. 22, Left.
	2. Poiney anicut system, map of tanks.	
	3 Poiney anicut system, map of tanks.	
	4. Pálár anicut system, northern section, group map.	
	5. Pálár anicut system, northern section, group map.	
	6 Pálár anicut system, southern section, group map	
	7. Chembrambakam tank system, group map.	
	8. Madras water-supply system, group map.	
	9. Cumbum tank, sketch map	
	10. Madurántakam tank, sketch map	
	11. Vallúru anicut, sketch map of channels	
	12. Srívaikuntam anicut system ..	
	13. Pelandorai anicut system	
	14. Chembrambakam tank, sketch map.	
	15. Breach in bund of do	
	16 Cunatur sluice	
	17. Mannapákam sluice	
	18. Kaveripák tank, supply channel ..	
	19. Kaveripák tank sluice . ..	
Irrigation Works, Buckingham Canal.	1 Index map of canal, north of Madras (5 sheets)	No. 23, Left.
	2. Index map of canal, south of Madras (2 sheets)	
Irrigation Works, Bari Duab Canal.	Set of 68 plans	Nos. 24, 25, 26 and 27, Left.
Rushikulya Project.	1. Sketch map, Rushikulya	No. 28, Left.
	2. Survey and levels of Gulleir channel (4 sheets).	
	3. Gulleri anicut and headworks ..	
	4. Borings at centre line of the Russellkonda reservoir dam.	
	5. Section at coffer dam, Russellkonda reservoir dam. .	
	6. Russellkonda reservoir head-sluice ..	
	7. Goomsur anicut and head works ..	
	8. Mahanadi canal survey and longitudinal sections (4 sheets).	
	9. Suradá reservoir showing proposed revised arrangement.	

LIST OF DRAWINGS—*continued.*

General Title.	Title of Drawing.	No. of Shelf.
Rushikulya Project—*cont.*	10. Sites of proposed embankment across the Pathama river and cutting to turn it into Suradá reservoir.	No. 28, Left.
	11. Proposed extension of embankment connected with diversion of river into Suradá reservoir.	
	12 Surplus weir for Suradá reservoir ..	
	13. Janamilly anicut across the Rushikulya river (sheet 1), Janamily head and scouring sluices (sheet 2)	
	14. Rushikulya canal survey and longitudinal sections (13 sheets).	
	15. Shergada aqueduct	
	16. Godahalo aqueduct	
	17. Under-tunnel, Rushikulya canal ..	
District maps, 8 miles to 1 inch showing Irrigation works.	1. Chingleput and Madras districts	No. 29, Left.
	2. Tanjore district	
	3 North Acrot district ..	
	4. Conjeeveram taluk	
	5. Tiruválúr taluk	
Building Drawing.—Brick-work, Plastering, and Painting.	1. Mason's work	No. 30, Left.
	2. Brick-work, footings and bond ..	
	3. Brick-work, superstructure (2 copies)	
	4. Brick-work plans of barracks ..	
	5. Brick-work, groined arches, circular vaulting.	
	6. Plasterer's and painter's work ..	
Building Drawing.—Carpentry.	1. Roofs	No. 31, Left.
	2. Lengthening and framing timbers ..	
	3. Floor on cast-iron girders	
	4. Roofs	
	5. Roofs of Exeter Hall	
	6. Shashes and frames for windows ..	
	7. Doors	
	8. Doors	
	9. Doors	
	10. Stair-cases	
Building Drawing.—Iron roofs.	1. Joints of wrought-iron roof of a workshop.	No. 32, Left.
	2. Details of roof truss, Central Station, Madras.	

LIST OF DRAWINGS—*continued.*

General Title.	Title of Drawing.	No. of Shelf.
Building Drawing.—Fire-proof Barracks for 100 men.	*Design No.* 1—	No. 33, Left.
	1. Plan, elevations and sections	
	2. Details of doors and windows	
	3. Details of W I. roof	
	Design No. 2—	
	1. Plans, elevations and sections	
	2. Details of W.I. roof	
	Design No. 3—	
	1. Plans, elevations and sections	
	2. Details of W.I. roof	
	3. Details of C.I. girders, upper floor.	
	4. Details of C.I. columns, girders, &c.	
	5. Details of C.I. railing for arcade	
	Designs Nos. 2 *and* 3—	
	1. Details of doors and windows	
	Designs Nos. 1, 2 *and* 3—	
	1. Details of tiles for roof	
Building Drawing.—P.W.D. standard designs for public buildings.	*Court-house for Sub-Judge*—	No. 34, Left.
	1. Elevations	
	2. Plan and sections	
	3. Sections	
	4. Court room front verandah	
	5. Verandah	
	6. Doors and windows, and property room.	
	7. Record room window	
	8. Property room window	
	9. Court and office rooms, trusses	
	10. Muntapam	
	11. Latrine	
	Sub-Registrar's office, Standard plan	
	Do. Alternate design	
	Deputy Tahsildar's Cutcherry	
	Mettapolliam Station House	
Elementary Building.—Construction illustrated by a design for an entrance.	1. General drawing of lodge showing ground and upper plans and front, rear and end elevations.	No. 35, Left.
	2. Enlarged plan of ground floor showing walls, the timbers, the finished floor, window and door frames, &c.	
	3. Enlarged plan of upper floor showing timbering of floor and finished floor plans of roofs of various parts, &c.	
	4. Enlarged plan of roof with sections showing various constructional details of roof.	

LIST OF DRAWINGS—*continued.*

General Title.	Title of Drawing.	No. of Shelf.
Elementary Building.—Construction illustrated by a design for an entrance—*cont.*	5. Section through building showing general arrangements of its several parts. 6. Detail of bay window of living room.	No. 35, Left.
Lodge and Gates by George Robson.	7 Detail of window of sitting room and stair case window. 8. Detail of entrance doorway .. 9. Details of internal doorway and of the framing forming closet on staircase landing 10. Details of staircase. 11. Details of gables, barge-boards, porch, &c. 12. Details of entrance gates and piers, fence, &c 13 Supplementary sheet A.—Details of a four-panel door and illustration of the different kinds of framing in joinery. 14 Supplementary sheet B.—Details of an ordinary window showing borings for shutters (architraves), &c.	
Building Drawing. — New High Court, Madras.	1 Plan of first floor Scale 15 feet to 1 inch 2. Plan of first floor Scale 30 feet to 1 inch. 3. East elevation 15 feet to 1 inch .. 4. West elevation. 15 feet to 1 inch .. 5 South elevation 15 feet to 1 inch .. 6. East, west and south elevations. 30 feet to 1 inch	No. 36, Left.
Building Drawing.—Drawing for estimating (4 sets).	A set of 67 estimating plans as set at College examinations.	Nos. 37, 38, 39, and 40, Left.
Bridges.—Stoney's well-sinking apparatus.	A sheet of photographs of Stoney's excavators.	No. 1, Right.
Topographical Plans.	1. City and environs of Jodhpur. 6 inches to 1 mile. 2. Gwalior fortress and city in four sheets. 6 inches to 1 mile (2 sets). 3. Simla and Jutog. 8 inches to 1 mile. 4. Hand-book of map printing, 19 plates 5. Hand-book of hill shading, 36 plates.	Nos. 2 and 3, Right.

LIST OF DRAWINGS—*continued.*

General Title.	Title of Drawing.	No. of Shelf.
State Railway Type Drawings.— Earth-work and masonry.	1. Type for progress sections	No. 4, Right.
	2. Type for progress sections	
	3. Cuttings and embankments	
	4. Cuttings and embankments ..	
	5. Well curbs	
	6. Well curbs	
	7. Well curbs	
	8. Well curbs	
	9. Arched bridges	
	10. Arched bridges	
	11. Abutments and piers	
	12. Large culverts	
	13. Small culverts and barrel drains ..	
	14. Retaining walls	
	15. Tunnel sections	
	16. Wire fencing	
State Railway Type Drawings.—Station buildings	1. Roadside station building	No. 5, Right.
	2. Double engine shed	
	3. Double engine shed	
	4. Engine shed for large stations ..	
	5. Iron roof, 35 feet span	
	6. Sheet iron roofing	
	7. Temporary sheds	
	8. Temporary sheds	
	9. Locomotive workshops	
	10. Locomotive workshops	
	11. Locomotive workshops	
	12. Inspection pit	
	13. Fixed crane	
	14. Bearing plates for flat-footed rails ..	
	15. Bearing plates for flat-footed rails ..	
	16. Scotch block	
	17. Blood's distant signal lever	
	18. Safety signals for level-crossing gates	
	19. Mile and gradient posts	
State Railway Type Drawings.— Girder bridges.	1. Live loads on girder bridges, metre gauge.	No. 6, Right.
	2. Girder bridge, 6′ span metre gauge.	
	3. Girder bridge, 12′ span metre gauge.	
	4. Girder bridge, 20′ span metre gauge.	
	5. Girder bridge, 40′ span metre gauge.	
	6. Girder bridge, 40′ span metre gauge.	
	7. Girder bridge, 60′ span metre gauge.	
	8. Girder bridge, 60′ span metre guage.	
	9. Girder bridge, 60′ span metre gauge.	
	10. Girder bridge, 100′ span metre guage.	
	11. Bridges for Nagpur and Chattisgarh Railways.	

LIST OF DRAWINGS.—*continued.*

General Title.	Title of Drawing.	No. of Shelf.
State Railway Type Drawings.— Girder bridges—*cont.*	12. Chumbla bridge .. .. .. 13. Live loads on girder bridges, 5′ 6″ gauge. 14. Girder bridge, 6′ span, 5′ 6″ gauge. 15. Girder bridge, 12′ span, 5′ 6″ gauge. 16. Girder bridge, 20′ span, 5′ 6″ gauge. 17. Girder bridge, 100′ span, 5′ 6″ gauge. 18. Chumbal bridge	No. 6, Right.
State Railway Type Drawings.—Rolling stock.	1. First-class carriage, metre gauge .. 2. First-class carriage, metre gauge .. 3. First-class carriage, metre gauge .. 4. Composite carriage, metre gauge .. 5. Second-class carriage, metre gauge. 6. Third-class carriage, metre gauge .. 7. Third-class carriage ambulance, metre gauge. 8. Luggage and post office van, metre gauge. 9. Horse box, metre gauge .. .. 10. Carriage truck, metre gauge .. 11. Iron covered goods wagon, metre gauge. 12. Iron covered goods wagon, metre gauge. 13. Iron covered goods wagon, metre gauge. 14. Iron high-sided goods wagon, metre gauge. 15. Iron low-sided goods wagon, metre gauge. 16. Ballast wagon, metre gauge .. 17. Platform wagon, metre gauge .. 18. Iron timber truck, metre gauge .. 19. Powder van, metre gauge .. .. 20. Under frame, side doors, metre gauge. 21. Under frame, end doors, metre gauge. 22. Under frame, goods wagon, metre gauge. 23. End platform arrangement, metre gauge. 24. Improved flexible buffers, &c., metre gauge.	No. 7, Right.
Stationary Engines.— Plates from 'Engineering.'	1. Worthington high-duty Pumping Engine. 2. Pumping Engines for Torpedo boats 3. Compound under-ground Pumping Engines.	No. 8, Right.

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LIST OF DRAWINGS—*continued.*

General Title.	Title of Drawing.	No. of Shelf.
Stationary Engines.—Plates from 'Engineering'—*cont.*	4. Centrifugal Pumping Engines ..	No. 8, Right.
	5. Compound Mill Engine	
	6. Pumping Machinery for the Water-works at Prague.	
	7. Horizontal Compound Tandem Mill Engine.	
	8. Tandem Compound Horizontal Engine.	
	9. Details of Horizontal Compound Engine.	
	10 Compound Corliss Engine	
	11. Do. do.	
	12. Do. do	
	13. Compound Engine	
	14. Under-ground Pumping Engine ..	
Locomotive Engines.—Plates from 'Engineering.'	1. Express Locomotive for the Caledonian Railway.	No. 9, Right.
	2. Tender for do.	
	3 Passenger Locomotive for the Caledonian Railway.	
	4. Fairlie Locomotive for the Royal State Railways of Saxony	
	5. Fairlie Locomotive for the Royal State Railways of Saxony.	
	6. Compound Express Locomotive (Borries system) for the Hanoverian State Railways.	
	7. Passenger and Goods Locomotive for the Uleaborg Railway.	
	8 Passenger and Goods Locomotive for the Uleaborg Railway.	
	9. Passenger and Goods Locomotive for the Uleaborg Railway	
	10. Passenger Locomotive for the Canadian-Pacific Railway.	
	11. Passenger Locomotive for the Canadian-Pacific Railway.	
	12. Locomotive details of do	
	13. Locomotive for the Belgian State Railways.	
	14. Locomotive for the Belgian State Railways.	
	15. Locomotive for the Belgian State Railways.	
	16. Standard types of Locomotives, Belgian State Railways.	
	17. Tank Locomotive for the Imperial Government Railways of Japan.	
	18. American Passenger and Freight Locomotives.	

General Title.	Title of Drawing.	No. of Shelf.
Locomotive Engines.—Plates from 'Engineering'—*cont.*	19. Consolidation Locomotive for the Canadian-Pacific Railway.	No. 9, Right.
	20. Four-wheel coupled Express Passenger Locomotive, L. & S.W.R.	
	21. Compound Tank Locomotive (Webb's system), L. & N.-W.R.	
	22. Tender for Express Locomotive, M.R.	
	23. Express Locomotive, M.R.	
	24. Compound Goods Locomotive, N.-E.R.	
	25. Compound Goods Locomotive, N.-E.R.	
	26. Tank Locomotive for the Imperial Railways of Japan.	
	27. Express Locomotive, M.R.	
	28. Express Locomotive, M.R.	
	29. Express Locomotive, M.R.	
	30. Bogie of Express Locomotive, N.-E.R.	
	31. Indicator Diagrams from Compound Locomotives, N.-E.R	
	32. Compound Passenger Locomotive, N.-E.R.	
	33. Compound Passenger Locomotive, N.-E.R.	
	34. Compound Passenger Locomotive, N.-E.R.	
	35. Compound Express Locomotive, N.-E.R.	
	36. Compound Express Locomotive, N.-E.R.	
Marine Engines.—Plates from 'Engineering.'	1. Torpedo Boat Compound Condensing Engines.	No. 10, Right.
	2. Compound Engines of Paddle Steamer.	
	3. Boilers of above Compound Engines.	
	4. Triple Expansion Engines of the S.S. *Enfield*.	
	5. Details of Triple Expansion Engines of the S.S. *Enfield*.	
	6. Engines and Boilers, Paddle Steamer *Mona's Queen*.	
	7. Triple Expansion Engines of the S.S. *Westmoreland*.	
	8. Quadruple Expansion Disconnective Engines of the Steam Yacht *Rion-nag-na-mara*.	

LIST OF DRAWINGS—*continued.*

General Title.	Title of Drawing.	No. of Shelf.
Marine Engines. —Plates from 'Engineering' —*cont.*	9. Engines and Boilers of the S.S. *Westmoreland.*	No. 10, Righ
	10. Triple Expansion Engines and Boiler of the *Gladiator.*	
	11. Triple Expansion Engines of the S.S. *Royal Prince.*	
	12. Triple Expansion Engines at the Edinburgh Exhibition.	
	13. Triple Expansion Engines at the Edinburgh Exhibition.	
	14. Quadruple Expansion Engines of the S.S. *County of York.*	
	15. Boilers of Quadruple Expansion Engines of the S.S. *County of York.*	
	16. Triple Expansion Engines of the Steam Yacht *Cassandra.*	
	17. Four-cylinder Disconnective Quadruple Expansion Engines of the Steam Yacht *Myrtle.*	
	18. Three-cylinder Disconnecting Marine Engine for the Ironclad *Nicholas.*	
	19. Triple Expansion Engines of H.M.S. *Orlando* and *Undaunted.*	
	20. Engines and Boilers of H.M.S. *Orlando* and *Undaunted.*	
	21. Triple Expansion Engines of the S.S. *Courier.*	
	22. Disconnective Quadruple Expansion Engines of the S.S. *Falls of Inversuaid.*	
	23. Quadruple Expansion Engines of the S.S. *Buenoscares.*	
	24. Triple Expansion Engines of the *City of New York.*	
	25. Triple Expansion Engines of the *City of New York.*	
	26. Engines and Boilers of S.S. *Islander.*	
Miscellaneous. —Plates from 'Engineering.'	1. Transfer Steamer *Cape Charles* ..	No. 11, Right.
	2. The New York City Water-works.	
	3. The Paddle Steamer *Kathleen Mavourneen.*	
	4. 4000-ton Hydraulic Forging Press.	
	5. Details of Fire Boat for the city of Cleveland.	
	6. Fire Boats.	
	7. Paddle Steamer *Mona's Queen* ..	
	8. Shearing Machine for Circular Plates.	

LIST OF DRAWINGS—*continued.*

General Title.	Title of Drawing.	No. of Shelf.
Miscellaneous. —Plates from 'Engineering' —*cont.*	9. Ice-making Plant	No. 11, Right.
	10. Twin Screw Hopper Dredger, 2 plates.	
	11. The Highgate Cable Tramway	
	12. Hauling Machinery at the Windsor Slipway.	
	13. Dividing Engine	
	14. 50-ton Radial block-setting Crane, 2 plates.	
	15. The S.S. *Nulli Secunda*, 2 plates	
	16. The Edinburgh International Exhibition, 2 plates.	
	17. The South African Diamond Fields.	
	18. Standard Types of Locomotive	
	19. New graving Docks on the Clyde	
	20. The Lexington Dry Crushing Silver Mills.	
	21. The S.S. *Orizata*	
	22. Rolling Mills for Cruciform Sections.	
	23. Pneumatic Moulding Machinery	
	24. Centrifugal Pumps	
	25. The Hydro-Pneumatic disappearing Gun Carriages.	
	26. Salvage Steamer and Tug Boat	
	27. Geological Sections Manchester Ship Canal.	
	28. Dock at Kowloon	
	29. Spanish Torpedo Boat *Ariete*	
	30. Jersey New Water-works	
	31. Rothersand Light House	
	32. Dome (75 feet diameter) for the 36th Equatorial Telescope at the Lick Observatory.	
	33. Roof of Machinery Hall at the Paris Exhibition.	
	34. Edinburgh Water-works	
	35. The San Fernando Dry Dock	
	36. The Italian Ironclad *Italia*	
	37. The Palace of the Liberal Arts Paris Exhibition.	
	38. The Fine Arts and Liberal Arts Galleries at Paris Exhibition.	
	39. H.M.S. *Magicienne* and *Marathon*.	
	40. Shears for cutting 30″ × 9″ slabs at the Clyde Bridge Steel Works.	
	41. Refrigerating machine	
	42. 12-ton Steam Goliath Crane	
	43. Paris Universal Exhibition of 1889.	
	44. Dry Dock at Esquimalt, 2 plates	
	45. Double Ladder Dredger	

LIST OF DRAWINGS—*continued.*

General Title.	Title of Drawing.	No. of Shelf.
Miscellaneous. —Plates from 'Engineering' —*cont.*	46. Italian Torpedo Boat *Fatinu* .. 47. The Maxim Gun .. .. .. 48. Cable traction on the New York and Brooklyn Bridge. 49. Hydraulic Lift at Louviére ..	No. 11, Right.
Indian Art Drawings.	1. 105 Sheets of Indian Art Drawings.	No. 12, Right.
Technical Art Series.	1. Indian Architectural Decorative Work, 3 sets of Plates I to XVIII.	No. 13, Right.

LIST OF GENTLEMEN WHO HAVE GAINED DIPLOMAS AS ENGINEE ON THE RESULTS OF EXAMINATIONS HELD IN CONNECTI WITH THE COLLEGE OF ENGINEERING, MADRAS.

(*Note.*—Names shown in Italics are those of independent candidates : all others are those of College students.)

No.	Name.	Diploma.	Remarks.
	1863.		
1	A. Rama Rau, B.C.E.	Assistant Engineer.	Passed with credit.
2	S. Subbarayachariar, B.C.E.	Do. do.	Do.
3	C. Kolandavelu Mudaliyar, B.C.E.	Do. do.	
4	Lieutenant C. C. Saxton, R.A.	Do. do	
5	P. Murugesa Mudaliyar	Do. do.	
6	G. Ratna Mudaliyar	Do do.	
	1864.		
7	St. J. H. Buchan	Assistant Engineer.	
	1865.		
8	Owen V. Norris, B.C.E.	Assistant Engineer.	
9	Alfred Grant, B.C.E.	Do. do.	
10	Lieutenant R F Taylor	Do do	
	1866.		
11	C. D. Potter	Assistant Engineer	Passed with credit.
12	N. Viraraghavulu Aiyar	Do. do	Do.
13	R. Hunter	Do do.	Do.
	1867.		
14	J. F. Gorman	Assistant Engineer.	
15	G. H. Rogers	Do. do.	
16	Lieutenant F. W Graham, H.M.'s 108th Regiment.	Do. do	
	1868.		
17	Captain G. P. Worster, S.C.	Assistant Engineer.	
18	James T. Simpson, B.C.E.	Do. do.	
19	R. Warder	Do. do.	
20	J. A. Price	Do. do.	
21	S. Mahadeva Aiyar	Do. do.	
22	A. McD. Salmon	Do. do.	

gineers.

Name.	Diploma.	Remarks.
1869.		
C. Chinnatambi Pillai	Assistant Engineer.	Passed with credit.
Edwin G. Lynn, B.C.E.	Do. do.	
Cecil H. T. Norfor	Do. do.	
1870.		
A. Hunter	Assistant Engineer.	
H. Arbuthnott	Do. do.	
E. R. Subbaraya Aiyar, B.A., B.C.E.	Do. do. ..	Passed with great credit.
1871.		
Lieutenant T. Greenaway, S.C. ..	Assistant Engineer.	
J. P. Arbuthnott	Do. do. ..	Passed with credit.
1873.		
N. Ratnasabhapati Pillai, B.A., B.C.E.	Assistant Engineer.	Passed with great credit.
J. E. Lafrenais, B.C.E.	Do. do. ..	Passed with credit.
W. A. Mathews	Do. do. ..	Do.
R. Kalyanarama Aiyar	Do. do. ..	Do
1874.		
W. McHutchin	Assistant Engineer.	
1875.		
R. C. Lowry	Assistant Engineer.	
1876.		
T. T. Ragava Chariyar, B.A., B.C.E.	Assistant Engineer.	Passed with great credit.
C. Mahadeva Sastri, B.A., B.C.E. ..	Do. do. ..	Do.
C.R. Chinnaswami Aiyangar, B.C.E.	Do. do. ..	Passed with credit.
E. A. French	Do do. ..	Do.
R. Vaidyanatha Aiyar, B.A., B.C.E.	Do. do. ..	Do.
S. Krishnama Chariyar, B.C.E. ..	Do. do. ..	Do.
C. Adikesavulu Nayudu, B.A., B.C.E.	Do. do. ..	Do.
K. Kuruvila	Do. do. ..	Do.
1877.		
S. Venkataramanayya, B.A., B.C.E.	Assistant Engineer.	Passed with credit.
K. C. Ninan	Do. do.	

No.	Name.	Diploma.	Remarks.
	1878.		
47	H. O'Flaherty	Assistant Engineer.	Passed with credit.
48	V. Nityananda Mudaliyar, B.A., B.C.E.	Do. do.	Do.
49	S. Saundararaja Aiyangar, B.A.	Do. do.	
	1879.		
50	S. Gopalakrishna Aiyar, B.C.E.	Assistant Engineer.	Passed with credit.
51	T. Subrahmanya Aiyar, B.A., B.C.E.	Do. do.	Do.
52	A. Nilakanta Sastri, B.C.E.	Do. do.	Do.
53	N. Rajagopala Aiyangar, B.C.E.	Do. do.	
54	S. Sesha Aiyangar	Do. do.	
	1880.		
55	Sylvester X. Saldanha, B.C.E.	Assistant Engineer.	Passed with credit.
56	Mir Sadr-ud-din	Do. do.	
	1881.		
57	Hormusji Nowroji, B.C.E.	Assistant Engineer.	Passed with credit.
	1883.		
58	K. Krishnan Nayar, B.A., B.C.E.	Assistant Engineer.	Passed with credit.
59	S. I. Vaikuntam Aiyar, B.A., B.C.E.	Do. do.	Do.
60	R. V. Narayana Aiyar, B.C.E.	Do. do.	Do.
61	A. G. Umamen	Do. do.	
62	A. R. Natesan, B.A., B.C.E.	Do. do.	
63	T. B. Sankara Sastri	Do. do.	
	1884.		
64	S. A. Subrahmanya Aiyar, B.A., B.C.E.	Assistant Engineer.	Passed with honours.
65	K. R. Rangaswami Aiyangar, B.C.E.	Do. do.	Passed with credit.
66	S. A. Swaminatha Aiyar, B.A.	Do. do.	Do.
67	V. R. Rangaswami Aiyar, B.C.E.	Do. do.	Do.
68	T. S. Sesha Aiyangar	Do. do.	Do.
69	J. E. A. D'Cruz, B.C.E.	Do. do.	
70	A. C. C. McLeish	Do. do.	
71	M. Ramakrishna Aiyar	Do. do.	
72	P. V. Raghava Chari	Do. do.	
73	P. G Venkatasubba Aiyar	Do. do.	
74	*S. G. Krishnaswami Aiyar*	Do. do.	

Engineers.

No.	Name.	Diploma.	Remarks.
	1885.		
75	R. A. Srinivasa Aiyangar, B.A., B.C.E.	Assistant Engineer.	Passed with honours.
76	U. Aiyaswami Aiyar, B.A., B.C.E.	Do. do. ..	Passed with credit.
77	R. V. Subrahmanya Aiyar, B.C.E.	Do. do. ..	Do.
78	G. V. Subrahmanya Aiyar, B.C.E.	Do. do. ..	Do.
79	M. A. Anantalwar, B.A., B.C.E. ..	Do. do.	
80	D. V. Jaganatha Chari, B.C.E. ..	Do. do.	
81	C. Madhava Rau	Do. do.	
82	T. Ramaswami Aiyangar ..	Do. do.	
	1886.		
83	R. Gopala Aiyar, B.A., B.C.E. ..	Assistant Engineer.	Passed with credit.
84	R. V. Sundaram Aiyar, B.A., B.C.E.	Do. do. ..	Do.
85	A. V. Panchapagesa Aiyar, B.A., B.C.E.	Do. do. ..	Do.
86	S. Lakshminarayana Aiyar, B.C.E.	Do. do.	
87	D. Sesha Charlu, B.A., B.C.E. ..	Do. do.	
88	N. Pranatartihara Sarma, B.C.E...	Do. do.	
89	V. K. Narayana Oonythan ..	Do. do.	
	1887.		
90	*S. Gopalachari*, B.C.E.	Assistant Engineer.	
	1890. *		
91	R. Srinivasa Aiyangar, B.A., B.C.E.	Civil Engineer ..	Gold medal.
92	J. M. Lacey, B.C.E.	Do.	
93	C. Kanakasuriyan Pillai ..	Do.	
94	V. Daivasikhamani Pillai, B.C.E...	Mechanical Engineer.	
	1891.		
95	G. R. Venkatarama Aiyar, B.C.E.	Civil Engineer ..	Gold medal.
96	V. T. Srinivasa Aiyangar, B.A., B.C.E.	Do. ..	Prize for Mathcs. and Science.
97	R. Everard	Do. ..	Prizes for Engineerg., Survg. and Drawg. and Gymnastics.
98	S. K. Ramaswami Aiyar	Do. ..	Prize for Gymnastics.
99	C. S. Venkatarama Aiyar, B.C.E.	Do.	
100	P. A. Venkatarama Aiyar, B.C.E.	Do.	
101	V. Rangaswami Aiyangar, B.C.E. .	Mechanical Engineer.	Prize for Workshop practice.
102	*V. Anantanarayana Aiyar* ..	Civil Engineer.	

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* Owing to the introduction of revised rules, extending the theoretical course to three years, and adding a practical course, the class succeeding that of 1886 passed the final examination in 1888, and received diplomas only on the completion of the practical course. They, therefore, appear under the heading "1890."

No.	Name.	Diploma.	Remarks.
	1892.		
103	A. V. Ramalinga Aiyar, B.A., B.C.E.	Civil Engineer ..	Gold medal. Prizes for Mathcs. and Science, and for Engineerg., Survg. and Drawg.
104	K. Gopala Aiyar	Do. ..	Prize for Vern. Lang. and Gymnastics.
105	A. Rajam Aiyar	Do.	
106	*R. Sundaram Aiyar*, B.C.E. ..	Do.	
	1893.		
107	L. D. Venkatarama Aiyar, B.A., B.C.E.	Civil Engineer ..	Gold medal. Prizes for Mathcs. and for Survg. and Drawing
108	John Kuriyan, B.A.	Mechanical Engineer.	Prizes for Engineerg., Science and Vern. Lang.
109	V. R. Pranatartihara Aiyar, B.A., B.C.E.	Civil Engineer.	
110	S. Rajagopalaswami Mudaliyar, B.C.E.	Mechanical Engineer.	Prize for Workshop practice.
	1894.		
111	G. S. Rama Aiyar, B.A., B.C.E. ..	Civil Engineer ..	Gold medal. Prize for Mathcs. and Survg.
112	V. Gopala Aiyar, B.C.E.	Do	
113	V. S. Ramakrishna Aiyar ..	Do. ..	Prize for Workshop practice
115.	P. Ranganayukulu Nayudu * ..	Do.	
	1895.		
116	R. N. Arokeaswami Mudaliyar, B.A., B.C.E.	Civil Engineer ..	Gold medal. Prizes for Survg. and Drawg. and for Workshop practice.
117	A. W. King, B.C.E.	Do. ..	Prizes for Engineerg., and for Mathcs.
118	M. Radhakrishna Aiyar, B.C.E. ..	Do.	

Completed his practical course in May 1895.

LIST of Persons who have been awarded Diplomas or Certificates of qualification as Engineer Subordinates on the results of Examinations held in connection with the College of Engineering, Madras.

(Note.—Names shown in italics are those of independent Candidates: all others are those of College Students.)

No.	Name.	Certificate.	Remarks.
	1858.		
1	C. Sambhayya	Assistant Overseer.	
2	C. Satakopam	Do. do.	
3	Mariyappa Mudaliyar	Do. do.	
4	Corpl. S. Briton, Sap. and Min.	Do. do.	
5	Gunr. F. Donelly, R. A.	Sub-Overseer, 1st Grade.	
6	C. Krishnaswami	Do. 1st Class.	
7	A. Varadarajulu	Do. do.	
8	C. Varadaraja Pillai	Do. do.	
9	Alexander Rhodes	Assistant Overseer.	
10	Samuel Claridge	Do. do.	
11	William Anderson	Sub-Overseer, 1st Class.	
12	Robert Anderson	Do. do.	
13	T. Ramaswami Nayudu	Do. 2nd Class.	
14	B. Sama Rau	Do. 1st Class.	
15	Corpl. Fuller, Sap. and Min.	Do. do.	
16	T. Franklin	Assistant Overseer.	
17	A. Gillon	Sub-Overseer, 2nd Class.	
18	George Allen	Do. 1st Class.	
19	Daniel O'Dogherty	Do. do.	
20	Corpl. W. White, Sap. and Min.	Do. do.	
21	V. Kodandarama Mudaliyar	Do. 2nd Class.	
22	M. Arumukha Mudaliyar	Do. 1st Class.	
23	T. Skipp	Assistant Overseer.	
	1859.		
24	J. W. Franklin	Assistant Overseer.	
25	T. Rangaswami Pillai	Sub-Overseer, 1st Class	
26	Thomas Barnett	Assistant Overseer.	
27	J. Adshead	Sub-Overseer, 1st Class.	
28	E. W. Godfrey	Assistant Overseer.	
29	Ambrose D'Sylva	Sub-Overseer, 2nd Class.	
30	T. Ramappa	Do. do.	
31	Sergt. D. Riordan, Sap. and Min.	Do. 1st Class.	
32	M. Venkanna	Do. do.	
33	C. Solayappan	Assistant Overseer.	
34	Sergt. J. A. Linehan, Sap. & Min.	Sub-Overseer, 1st Grade, 1st Class.	

Engineer Subordinates.

No.	Name.	Certificate.	Remarks.
35	George Allen	Assistant Overseer.	
36	R. Harris	Do. do.	
37	C. Murugesa Mudaliyar	Sub-Overseer, 1st Class.	
38	C. Mariyappa Mudaliyar	Do. do.	
39	2nd Corpl. J. Olive, Sap. and Min.	Assistant Overseer.	
40	A. J. Alvares	Sub-Overseer, 1st Class.	
41	W. Loftus	Assistant Overseer.	
42	Michael Rodrigues	Sub-Overseer, 2nd Class.	
43	Thomas Fouracres	Assistant Overseer.	
44	J. Latimer	Do. do.	
45	C. Velayuda Mudaliyar	Sub-Overseer, 2nd Class.	
46	M. Manikka Mudaliyar	Assistant Overseer.	
	1862.		
47	J. A. Hamnett	Assistant Overseer.	
48	Charles Williams	Sub-Overseer, 1st Class.	
49	T. Parthasarathi Aiyangar	Assistant Overseer.	
50	M. Appavu Pillai	Sub-Overseer, 2nd Class.	
51	T. A. Appavu	Do. do.	
52	V. Venkataswami Aiyar	Assistant Overseer.	
53	Paul Rodrigues	Sub-Overseer, 2nd Class.	
54	C. Krishnaswami	Assistant Overseer.	
55	L.-Corpl. C. Lloyd, 1st M. Fuslrs.	Sub-Overseer, 1st Class.	
56	A. Vadivelu Mudaliyar	Do. 2nd Class.	
57	M. Munuswami Mudaliyar	Do. do.	
58	Thomas King	Do. do.	
59	Bharum Venkanna	Do. 1st Class.	
60	C. Muttuswami Pillai	Do. 2nd Class.	
61	T. Subrahmanya Pillai	Assistant Overseer.	
62	M. Guruswami Mudaliyar	Sub-Overseer, 1st Class.	
63	A. Tyagaraya Mudaliyar	Do. 2nd Class.	
64	W. P. Evans	Assistant Overseer.	
65	Pte. C. Seton, Drag. Gds.	Do. do.	
66	M. Plumbe	Do. do.	
67	J. Price	Do. do.	
68	T. C. D'Rozario	Do. do.	
69	R. Kumaradevu Mudaliyar	Do. do.	
70	P. Venkatanarasu Nayudu	Do. do.	
71	Saiyid Yusuf Sahib	Do. do.	
72	N. Murugesa Mudaliyar	Sub-Overseer, 1st Class.	
73	J. H. Scott	Assistant Overseer.	
74	A. Watkins	Sub-Overseer, 1st Class.	
75	E. Subhayya	Do. 2nd Class.	
76	P. Purushottama Nayudu	Do. do.	
77	D. Ramachandran	Do. do.	
78	A. Narayanaswami	Do. do.	
79	M. N. Adaikkalam Pillai	Do. do.	
80	G. A. Thompson	Assistant Overseer.	
81	S. Ramachandra Mudaliyar	Sub-Overseer, 2nd Class.	

No.	Name.	Certificate.	Remarks.
	1861.		
82	*C. Chokkalinga Mudaliyar*	Sub-Overseer, 2nd Class	
83	*W. Narasimhulu*	Do. 1st Class.	
84	*Edmund Haldwell*	Asst. Overseer, Mysore	
85	*E. B. G. C. Canisth*	Sub-Overseer, 2nd Class.	
86	*Thomas T. Leonard*	Asst. Overseer, Mysore.	
87	John William Ellis	Assistant Overseer	R.E Officers' prize; 1st prize for Mathcs.; 2nd prize for Civ. Eng.; 1st prizes for Survg., Drawg. and Language.
88	William Donaghue	Do. do.	2nd Prizes for Survg. and Drawg.
89	Fabian Watkins	Do do.	1st prize for Civ. Eng. and 3rd for Mathcs.
90	Mark Dunhill	Do. do.	
91	Samuel Maddox	Do. do.	
92	C. Arunachalam	Do. do	
93	Corpl. W. Finniston, 91st Regt.	Do. do.	
94	J. O'Neill	Do do	2nd prizes for Mathcs. and Language.
95	Corpl. J. Grimes, 102nd M. Fuslrs.	Do. do.	
96	Sergt. J. Fitzgibbon, 108th M. Infy.	Do. do.	
97	Pte. R. Elliot, 1st Drag. Gds.	Do. do	
98	P. Purushottama Nayudu	Sub-Overseer, 1st Class.	
99	John T. Ross	Do. do.	
100	Henry Swayne	Do do	
101	*B. Ramayya*	Do. 2nd Class	
102	*Charles Hodgson*	Do 1st Class.	
103	*Venkatarama Aiyar*	Do. 2nd Class.	
104	*Corpl. F. McGovin, 74th Highlanders.*	Asst. Overseer, Mysore.	
105	*Corpl. J. Keenan, Sap and Min.*	Sub-Overseer, 1st Class	
106	*Corpl. J. Keenan, Sap. and Min.*	Asst. Overseer, Mysore.	
107	*T. Ratnavelu Mudaliyar*	Sub-Overseer. 2nd Class.	
108	*B. Viravenkayya*	Do. do.	
109	*C. Murugesa Mudaliyar*	Do do	
	1862.		
110	*James Egan*	Asst. Overseer, Mysore.	
111	*Charles Hodgson*	Do. do.	
112	Pte. John Mitchell, Eff. Supernumeraries.	Assistant Overseer	1st prize for Civ. Eng.; 2nd prize for Geology, and R.E.Officers' prize.
113	Gunr. M. Higgins, Eff. Supernumeraries.	Do. do.	1st prizes for Mathcs. and Survg.
114	John William Fox	Do. do.	1st prizes for Language and Geology.
115	Sergt. W. Moore, 17th Lancers	Do. do.	2nd prizes for Mathcs. and Civ. Eng.
116	Corpl. J. McAdam, Eff. Supernumeraries.	Do. do.	
117	Sergt. K. F. Nordman, Sap. and Min.	Do. do.	1st prize for Drawg. and Estimg.

Engineer Subordinates.

No.	Name.	Certificate.	Remarks.
118	2nd Corpl. L. A. Sayce, Sap & Min.	Assistant Overseer.	
119	Pte. John Conners, Eff. Supernumeraries.	Do. do.	
120	Gunr. James Kinsella, do. ..	Do. do. ..	3rd prize for Mathcs.
121	Gunr. John Taylor, do. ..	Do. do.	
122	Robert Shaw	Do. do.	
123	P. Annadurai	Do. do.	
124	Pte. D. McNab, 74th Highlanders.	Do. do.	
125	John Fonseca	Do. do.	
126	Sergt. J. Carey, Sap. and Min. ..	Do. do.	
127	W. H. Kehoe	Do. do.	
128	Pte. John Forkgen, Eff. Supernumeraries.	Do. do.	
129	Corpl. Joseph Austin, do. ..	Do. do.	
130	Drumr. Henry Smith, do. ..	Do. do.	
131	Joseph Pillai	Sub-Overseer, 1st Class.	
132	Corpl. Joseph Hill, 91st Regt. ..	Do. do.	
133	Gunr. James Sinclair, Eff. Supernumeraries.	Do. do.	
134	C. Seshachalam	Do. do.	
135	B. de Prazer	Do. do. ..	2nd prize for Language.
136	*G. Chinnakannu Pillai*	Do. 2nd Class.	
137	*Kumaraguru Mudaliyar*	Do. do.	
138	*T. Ayyavu Mudaliyar*	Do. do.	
139	*T. R. Rangaswami*	Do. do.	
140	*John Marcan*	Do. 1st Class.	
141	*Thomas Tod*	Assistant Overseer.	
142	*Muhammad Qasim*	Sub-Overseer, 2nd Class.	
143	*E. O'Neill*	Asst. Overseer, Mysore.	
144	*Ramaswami Achari*	Sub-Overseer, 2nd Class.	
145	*Sergt. James Cormac, Sap. and Min.*	Do. do.	
	1863.		
146	*Thomas Lazarus*	Sub-Overseer, 1st Class, Bengal.	
147	Gunr. W. E. Lippert, R. A. ..	Assistant Overseer ..	2nd prizes for Mathcs. and Survg.; 1st for Drawg.: R.E. Officers' prize, and 1st prize for Language.
148	Corpl. Thomas Rooney, Sap. and Min.	Do. do. ..	1st prize for Mathcs.; 2nd for Drawg.; and prize for Chemistry.
149	Corpl. John Nicholson, do. ..	Do. do. ..	2nd prizes for Civ. Eng. and Geology.
150	Gunr. T. Spurr, R. A.	Do. do. ..	1st prize for Civ. Eng.; 3rd prizes for Mathcs. and Survg.
151	Sergt. James Schoury, Sap. and Min.	Do. do.	
152	Corpl. T. H. Tate, do. ..	Do. do.	
153	Corpl. Allen Smith, do. ..	Do. do.	
154	T. Chokkalingam Pillai ..	Do. do.	
155	Pte. R. Skehan, 1st Drag. Gds. ..	Do. do.	

No.	Name.	Certificate	Remarks.
156	Corpl. Thomas Mullins, Sap. & Min.	Assistant Overseer ..	2nd prize for Language. 1st prizes for Survg. and Geol.
157	Corpl. John Allen, do. ..	Do do.	
158	Corpl. W. C. West, do ..	Do. do.	
159	Corpl. J. B. Sanderson, do. ..	Do. do.	
160	Corpl. James Telford, do. ..	Do do	
161	Sergt J. Parker, 102nd M. Fuslrs.	Do. do.	
162	Pte. F. Barnes, 17th Lancers ..	Do. do.	
163	Sergt. J. Ballard, Sap. & Min. ..	Do do.	
164	Corpl. J. F. Slade, do. ..	Do do.	
165	Corpl. W. Dalby, do. ..	Do. do.	
166	Corpl. J. C. Littlewood, do. ..	Do. do.	
167	Corpl. J. Ellison, do. ..	Do. do	
168	Corpl. A. Nicholson, do ..	Do. do. Bengal.	1st prize for Chemistry.
169	H. C. Berlie	Do. do. do.	
170	Corpl. F. Washington, Sap. & Min.	Do. do. do.	
171	*C. Varadaraja Pillai*	Do. do. do.	
172	*Sergt. Adam Watson, Sap. & Min.*	Do. do. do.	
173	*John O'Leary*	Taluk Overseer.	
	1864.		
174	E. Grant	Taluk Overseer	
175	R. T. Scaldwell	Do. do.	
176	G. Bay	Do do.	
177	J. D. Legge	Do. do	
178	C. D. Potter	Do. do	
179	M. Chinnaswami Pillai	Do. do.	
180	R. Arbuthnott	Do. do.	
181	Corpl. R. Green, Sap. & Min. ..	Asst Overseer, Bengal.	
182	J. E. Rodgers	Do. do.	
183	Corpl. J. Heywood, Sap. & Min. ..	Do. do.	
184	W. V. Baker	Taluk Overseer.	
185	B. Stephens	Do. do.	
186	Corpl. R. R. Richmond, Sap. & Min.	Asst. Overseer, Bengal.	
187	J. A. Minchall	Taluk Overseer.	
188	J. H. Stephens	Do do.	
189	S. Parthasarathi Nayudu ..	Do. do.	
190	P. Dorsey	Do. do.	
191	R. W. Carr	Do. do.	
192	P. Murugesa Pillai	Do. do.	
193	B. Munuswami Chetti ..	Do. do.	
194	P. Kuppuswami Nayudu ..	Sub-Overseer, 2nd Class.	
195	C. Daivasikhamani Mudaliyar ..	Do. 3rd Class.	
	1865.		
196	*W. Ewing*	Taluk Overseer.	
197	*C. Kuppuswami Nayudu*	Asst. Overseer, Bengal.	
198	*B. C. Dumphy*	Asst. Overseer.	
199	*Corpl. James Cormac, Sap. & Min.*..	Taluk Overseer.	

Engineer Subordinates.

No.	Name.	Certificate.	Remarks.
200	Corpl. J. Hamilton, Sap. & Min.	Taluk Overseer	R.E. Officers' prize; 1st prize for Mathcs.; 2nd for Civ. Eng., and prize for Tamil.
201	J. Jackson	Do. do.	2nd prize for Mathcs.; 1st prizes for Civ. Eng., Survg., and Drawg., and Estimg.
202	Pte. G. Wallace, 18th R.I. Regt...	Do. do.	3rd prize for Mathematics
203	Sergt. R. Lennon, Sap. & Min. ..	Do. do.	2nd prizes for Survg., Drawg. and Estimg., and Geol.
204	S. Rama Rau	Do. do.	
205	Corpl. A. Crowe, Sap. and Min...	Do. do.	
206	Segt. W. Barrett, do. ..	Do. do.	Prize for Telugu.
207	Gunr. R. Gibson, R. A. ..	Asst. Overseer, Bengal.	
208	S. Rangaswami Nayudu ..	Do. do.	
209	P. Mahoney	Do. do.	
210	Corpl. W. Buckley, Sap. & Min..	Do. do.	
211	Corpl. C. Briant, do. ..	Do. do.	
212	S. K. Govinda Rau	Sub-Overseer, 2nd Class.	
213	W. Stephenson	Asst. Overseer, Bengal.	
	1866.		
214	*Munuswami Nayudu*	Sub-Overseer, 2nd Class.	
215	*F. G. Croaker*	Taluk Overseer.	
216	Q. M. Sergt. A. Milne, R. A. ..	Do. do.	R.E. Officers' prize; 1st prizes for Civ. Eng., Drawg., Estimg., and 2nd prize for Survg.
217	Pte. S. Munn, 105th Regt. ..	Do. do. .. .	2nd prizes for Mathcs. and Civ. Eng.; 1st prize for Survg.
218	Pte. J. Lalor, 105th Regt. ..	Do. do.	1st prize for Mathcs., and 2nd for Drawg. and Estimg.
219	Pte. W. Hyde, 16th Lancers ..	Do. do.	
220	J. D. R. Dighton	Do. do.	
221	Gunr. H. V. Appleby, Rl. H. Art.	Do. do.	
222	L.-Corpl. R. Bamfield, 105th Regt.	Do. do.	
223	G. Thyria Pillai	Do. do.	3rd prize for Mathematics
224	Pte. W. Brewar, 2/21st Fusiliers..	Do. do.	
225	A. S. Johnson	Do. do.	Prize for Tamil.
226	J. E. Prout	Do. do.	
227	P. Thomas	Asst. Overseer, Bengal.	
228	F. Cripps	Do. do.	
229	J. Elliot	Do. do.	
230	G. W. K. Martin	Do. do.	
231	*J. Donaghue*	Taluk Overseer.	
232	*B. C. Dumphy*	Do. do.	
233	*T. Ramaswami Nayudu*	Do. do.	
234	*Corpl. R. R. Richmond, Sap. & Min.*	Do. do.	
235	*P. Mahoney*	Do. do.	
236	*A. G. King*	Overseer, Bengal.	
	1867.		
237	A. M. Walter	Taluk Overseer ..	R.E. Officers' prize; prize for Tamil; 1st prize for Drawg. and 3rd for Mathcs.

No.	Name.	Certificate.	Remarks.
238	H. M. Bond	Taluk Overseer	1st prize for Survg. and 2nd for Civ. Eng.
239	P. Doyle	Do. do.	1st prize for Mathcs., and Principal's prize for monthly examination.
240	E. M. Gill	Do. do	1st prize for Civ. Eng.; 2nd prizes for Mathcs. and Survg.
241	P. T. Kelly	Do do	Prize for Telugu, and 2nd prize for Drawg. and Estimg.
242	John Coghlan	Do. do.	
243	E. V. Beeby	Do. do.	
244	C. J. Hennessy	Do. do.	Prize for Geology
245	C. E. Court	Do. do.	
246	B. P. Hoogewerf	Do. do.	
247	Gunr. P. Quinn, R. A.	Do. do.	
248	T. F. Revis	Do. do.	
249	Gunr. H. Hollingsworth, R. A.	Do. do.	
250	K. C. Visvanatha Aiyar	Do. do.	
251	H. E. Hogg	Do. do.	
252	C. S. Narayanaswami Aiyar	Do. do	
253	T. V. Sitarama Mudaliyar	Overseer, Bengal.	
254	Sergt. G. Maile, Sap. and Min.	Do. do	
255	A. Narayanswami Mudaliyar	Do. do.	
256	L. Pereira	Do. do.	
257	J. Marchant	Do. do.	
258	John Samuel	Do. do.	
259	Arumunayagam	Do. do.	
260	P. Ramsavuk Panday	Do do.	
261	*J. E. Ottmann*	Do. do.	
	1868.		
262	*J. Marchant*	Taluk Overseer.	
263	*John William Ellis*	Sub-Engineer.	
264	Corpl. William Cames. R. A.	Taluk Overseer	R.E. Officers' prize; 1st prize for Mathcs.; Principal's prize for monthly examination.
265	P. Ratnaswami Mudaliyar	Do. do.	2nd prize for Mathcs.
266	Corpl. W. Willis, R. H. A.	Do. do.	1st prize for Civ. Eng.
267	Sergt. G. Gorman, 2/21st Regt.	Do. do.	1st prize for Survg.; prize for Chem. and Telugu.
268	Corpl. J. McAleese, R. A.	Do. do	2nd prize for Drawg. and Estimg.
269	J. Power	Do. do.	Prize for Tamil.
270	J. Taylor	Do. do.	3rd prize for Mathcs., and 2nd prize for Civ. Eng.
271	Sergt. W. Spencer, Sap. & Min.	Do. do.	1st prize for Drawg. and Estimg.
272	Pte. W. Veitch, 2/10th Regt.	Do. do.	2nd prize for Surveying.
273	K. Duraiswami Pillai	Do do.	
274	Saiyid Muhammad Sharf-ud-din	Do. do.	
275	F. Secluna	Do. do.	
276	Pte. T. Smith, 102nd Regt.	Do. do.	
277	E. Taylor	Do. do.	
278	S. B. Rebello	Do. do.	
279	J. Hennessy	Do. do.	
280	V. Ratna Mudaliyar	Do. do.	

Engineer Subordinates.

No.	Name.	Certificate.	Remarks.
281	J. Lawrence	Taluk Overseer.	
282	R. Gamble	Do. do.	
283	Pte. C. Ward, 102nd Regt.	Overseer, Bengal.	
284	Muhammad Yaqub	Do. do.	
285	Drv. W. Pearson, R. A.	Do. do.	
286	Pte. J. Kelly, 102nd Regt.	Do. do.	
287	Pte. H. Russel, do.	Do. do.	
288	*P. Balasundara Mudaliyar*	Do. do.	
289	*W. H. Cottrell*	Do. do	
290	*T. V. Sitrama Mudaliyar*	Taluk Overseer.	
291	*T. Malligespuram Pillai*	Do. do.	
292	*J. Wade*	Do. do.	
293	*R. W. Thorpe*	Do do.	
	1869.		
294	*Abdul Karim Khan*	Taluk Overseer.	
295	*S. Ranganatha Mudaliyar*	Do. do.	
296	*T. W. Butfry*	Overseer, Bengal.	
297	J. C. Ford	Taluk Overseer	R.E Officers' prize; 1st prizes for Mathcs., Civ. Eng., Survg. and Drawg. and Estimg., and Principal's prize for monthly examination
298	Sergt. J. Smith, R. A.	Do. do.	2nd prize for Civ. Eng.
299	W. H. Hiscox	Do. do	2nd prize for Drawg. and Estimg.
300	P. Nery	Do do.	2nd prize for Surveying
301	J. Mahoney	Do. do.	2nd prize for Mathematics
302	S. T. Winfred	Do do.	
303	Pte. W. Bennett, 2/21 Fuslrs.	Do do	
304	Sergt. J. Bennett, do.	Do. do.	
305	A. J. Warner	Overseer, Bengal	2nd prize for Language.
306	C. Rajagopala Nayudu	Do do.	
307	A. Vedagiri Mudaliyar	Do. do	
308	N. Ranguswami Pillai	Do. do.	
309	P. Ramnarain Ponday	Do. do.	
310	S. Narayanaswami Aiyar	Do. do.	
311	L. R. Mitchell	Do. do.	1st prize for Language.
312	T. O'Leary	Do. do.	
313	G. S. Krishnaswami Aiyar	Do. do.	
314	Driv. R. Wolfe, R. A.	Do. do.	
315	*T. Daly*	Do. do.	
316	*J. E. Ottmann*	Taluk Overseer.	
317	*L.-Corpl. P. Mulrenan, 2/10 Regt.*	Overseer, Bengal.	
318	*Gunr. J. Dunn, R. H. A.*	Do. do.	
319	*T. Kelly*	Do do.	
320	*C. C. Rebeiro*	Do. do.	
321	*M. S. Varadaraja Aiyar*	Do. do.	
322	*J. T. Doyle*	Do. do.	
323	*P. Ramsavuk Ponday*	Taluk Overseer.	

No.	Name.	Certificate.	Remarks.
	1870.		
324	*N. Chinnaswami Pillai*	Overseer, Bengal.	
325	*M. P. Scanlon*	Do. do.	
326	*E. Dady*	Taluk Overseer.	
327	*H. W. Taylor*	Overseer, Bengal.	
328	Sergt. D. Falvey, Sap. and Min	Taluk Overseer	R. E. Officers' prize ; 1st prizes for Eng. and Mathcs., and prize for Tamil.
329	Bombr. R. Ward, R. A.	Do. do.	Prize for Mathcs. ; 2nd prizes for Eng. and Drawg.
330	Sergt. F. Heinig, Rl. Engs.	Do. do.	1st prizes for Survg. and Drawg.
331	Sergt. H. Frankland, Rl. Engs.	Do. do.	Prize for Survg. and Drawg.
332	Bombr. J. Mahoney, R. A.	Overseer, Bengal.	
333	Sergt. H. Perrin, Rl. Engs.	Do. do.	
334	C. Ramachandra Rau	Do. do.	
335	*A. Narayanaswami Mudaliyar*	Taluk Overseer.	
336	*Pte. C. Ward,* 102*nd Regt.*	Do. do.	
337	*Driv. W. Pearson, R. A.*	Do. do.	
338	*J. Carroll*	Do. do.	
339	*Bombr. H. Webb, R. A.*	Overseer, Bengal.	
340	*A. Muttuswami Pillai*	Do. do.	
341	*Bombr. J. Thompson, R. A.*	Do. do.	
342	*P. Krishnamachari*	Do. do.	
343	*Gunr. B. McKeon, R. A.*	Do. do	
344	*Pte. P. Twohig,* 18*th Hussrs.*	Do. do.	
345	*E. Reardon*	Do. do.	
	1871.		
346	*P. Ramnarain Ponday*	Taluk Overseer.	
347	*John William Scanlon*	Overseer, Bengal.	
348	*D. Brickenridge*	Do. do.	
349	Sergt. W. Taylor, 2/19th Regt.	Taluk Overseer	R.E. Officers' prize ; 1st prizes for Civ. Eng. and Drawg. and Estimg.
350	Sergt. J. Armitage, Rl. Engs.	Do. do.	3rd prize for Civ. Eng. ; 1st prize in Survg., and 2nd prize in Drawg. and Estimg.
351	J. R. Gorman	Do. do.	1st prize for Mathematics.
352	M. L. Frank	Do. do.	2nd prize for Mathematics.
353	S. Lazarus	Do. do.	
354	J. Kelly	Do. do.	1st prize for Tamil.
355	C. Ponnuswami Pillai	Do. do.	
356	Corpl. R. McAlister, 76th Regt.	Do. do.	2nd prizes for Civ. Eng. and Tamil.
357	J. Timothy	Do. do.	
358	P. M. Arumukham Pillai	Overseer, Bengal.	
359	T. Munuswami Mudaliyar	Do. do.	
360	Driv. J. Patton, R. A.	Do. do.	
361	Gunr. H. Sears, R. A.	Do. do.	
362	J. Tobin	Do. do.	
363	H. Bowers	Do. do.	

Engineer Subordinates.

No.	Name.	Certificate.	Remarks.
364	M. Francis	Overseer, Bengal.	
365	Gunr. J. Healey, R. A.	Do. do.	
	1872.		
366	*Gunr. A. Murray, R. A.*	Taluk Overseer.	
367	*Driv. J. Patton, R. A.*	Do. do.	
368	*Gunr. H. Sears, R. A.*	Do. do.	
369	*T. Munuswami Mudaliyar*	Do. do.	
370	N. Nadamuni Mudaliyar	Do. do.	R.E. Officers' prize, 2nd prize for Mathcs.; 1st prize for Survg. and Drawg. and Estimg., and Principal's prize for monthly examination.
371	C. Krishnayya	Do. do.	1st prize for Mathematics.
372	J. C. Dennehy	Do. do.	
373	J. W. Jackson	Do. do.	2nd prize for Eng. and prize for Tamil.
374	C. Duraiswami Mudaliyar	Do. do.	
375	J. Tims	Do. do.	Prize for Telugu.
376	Sergt. A. Lord, 18th Hussars	Do. do.	
377	C. Hawke	Do. do.	2nd prize for Survg.
378	E. Vigor	Do. do.	
379	T. Ramanuja Pillai	Do. do.	
380	Gunr. J. Edwards, R. A.	Do. do.	2nd prize for Drawg. and Estimg.
381	C. W. Traish	Do. do.	
382	Corpl. G. Perris, 45th Regt.	Do. do.	
383	T. O. Fitzgerald	Do. do.	
384	T. Kesava Rau	Overseer, Bengal.	
385	S. M. Krishna Rau	Do. do.	
386	Gunr. E. Cope, R. A.	Do. do.	
387	Bombr. R. Lisles, R. A.	Do. do.	
388	Corpl. G. Bennett, 45th Regt.	Do. do.	
389	*Bombr. H. Webb, R. A.*	Taluk Overseer.	
390	*Gunr. E. Cope, R. A.*	Do. do.	
391	*Corpl. G. Bennett, 45th Regt.*	Do. do.	
392	*Sergt. J. Healey, R. A.*	Do. do.	
	1873.		
393	*Richard A. Salisbury*	Taluk Overseer.	
394	Col.-Sergt. C. Stewart, 1/21st Regt.	Supervisor	R.E. Officers' prize; 1st prizes for Mathcs., Eng., Survg. and Drawg.; prize for Telugu, and Principal's prize for monthly examination.
395	Abdul Latif Sahib	Taluk Overseer	2nd prizes for Mathcs. Eng. and Survg.
396	M. Venkataswami Nayudu	Do. do.	
397	Robert John Patrick Enright	Do. do.	2nd prize for Drawing.
398	K. Narasimhachari	Do. do.	
399	Muhammad Azim-ud-din	Do. do.	
400	Ag. Bombr. R. A. Bragg, R. A.	Do. do	3rd prize for Drawing.

No.	Name.	Certificate.	Remarks.
401	S. Panchapagesa Aiyar	Taluk Overseer.	
402	T. Venkataswami Chetti	Do. do.	
403	T. B. Ramaswami Nayudu	Do. do.	
404	Corpl. J. Wilkinson, R. A.	Do. do.	
405	Col.-Sergt. T. Lyons, 89th Regt.	Do. do.	Prize for Photography.
406	U. N. Joyce	Do. do.	
407	*Leo Pereira*	Do do.	
	1874.		
408	*S. J. Peters*	Taluk Overseer.	
409	*Joseph Pillai*	Do. do.	
410	*C. Seshachalam*	Do. do.	
411	*S. Rangaswami Nayudu*	Do. do.	
412	*P. Mahoney*	Do. do.	
413	*J. Samuel*	Do. do.	
414	*P. Balasundara Mudaliyar*	Do. do.	
415	*A. Vedagiri Mudaliyar*	Do. do.	
416	*N. Rangaswami Pillai*	Do. do.	
417	*Bombr. J. Mahoney, R. A.*	Do. do.	
418	*A. Muttuswami Pillai*	Do. do.	
419	*P. M. Arumukham Pillai*	Do. do.	
420	*Sergt. J. Kelly, 102nd Regt.*	Do. do.	
421	*Arumanayagam*	Do. do.	
422	*Muhammad Yakub*	Do. do.	
423	Corpl. J. E. Chapman, 48th Regt.	Do. do.	R.E. Officers' prize; 2nd prize for Mathcs.; 1st prizes for Eng., Survg. and Drawg.; prize for Telugu, and Principal's prize for monthly examination.
424	M. Raju Mudaliyar	Supervisor	2nd prize for Engineering.
425	A. S. Asirvadam Pillai	Do.	1st prize for Mathematics.
426	Corpl. E. Tydeman, 18th Hussars.	Do.	Prize for Tamil.
427	S. Vijayaraghavulu Doss	Taluk Overseer	2nd prize for Surveying.
428	Muhammad Jafar Husain Sahib.	Do. do.	
429	Sergt. A. Temple, 89th Regt.	Do. do.	2nd prize for Drawing and prize for Photography.
430	V. Kuppuswami Aiyangar	Do. do.	
431	T. Muttukumaraswami Mudaliyar.	Do. do.	
432	K. Visvanathayya	Do. do.	
433	W. Masilamani Mudaliyar	Do. do.	
434	P. Whitbread	Do. do.	
435	D. Muttirulappa Pillai	Do. do.	
436	A. Tyagaràja Aiyar	Do. do.	
437	F. Hennessey	Do. do.	
438	R. Srinivasa Chari	Do. do.	
439	Corpl. R. Healy, 89th Regt.	Do. do.	
440	S. Raghava Aiyangar	Do. do.	
441	H. A. Taylor	Do. do.	
442	S. Trutwein	Do. do.	
443	S. Krishnayya	Do. do.	
444	V. R. Kuppuswami Mudaliyar	Do. do.	
445	M. Muttu Nayudu	Do. do.	

Engineer Subordinates.

No.	Name.	Certificate.	Remarks.
446	*R. F. Thomas*	Taluk Overseer.	
447	*J. Pereira*	Do. do.	
448	*Corpl. J. E. Chapman, 48th Regt.*..	Supervisor.	
	1875.		
449	*N. Venkataranga Pillai*	Taluk Overseer.	
450	*A. Muttuswami Mudaliyar* ..	Do. do.	
451	M. Subha Rau Nayudu	Supervisor	R.E. Officers' prize; 1st prize for Eng.; 2nd prize for Survg., and Principal's prize for monthly examination.
452	T. Gnanasambantham Pillai ..	Taluk Overseer ..	2nd prize for Mathcs. and Drawg.
453	M. Ranga Rau Pantulu	Do. do.	2nd prize for Engineering.
454	A. Murugesa Mudaliyar	Do. do.	1st prize for Survg. and Drawg.
455	C. Ramana Pantulu	Do. do.	
456	G. Manikkam Chetti	Do. do.	1st prize for Mathcs.
457	A Ramalinga Mudaliyar ..	Do. do.	
458	M. Kannu Pillai	Do. do.	
459	A. E. C. Vas	Do. do.	
460	T. Arumukham Pillai	Do. do.	
461	P. Narayanaswami Nayudu ..	Do. do.	
462	M. Madhava Rau Pantulu ..	Do. do.	
463	C. Varadarajulu Mudaliyar ..	Do. do.	
464	H. C. Poole	Do. do.	Prize for Telugu.
465	J. M. Masilamani Pillai	Do. do.	
466	D. S. Newnan	Do. do.	Prize for Tamil.
467	A. P. Murugesa Pillai	Do. do.	
468	S. Muttayya Pillai	Do. do.	
469	V. Bhashyam Aiyangar	Do. do.	
470	S. Vedanayaka Thevar	Do. do.	
471	E. Barren	Do. do.	
472	C. Subrahmanya Aiyar	Do. do.	
473	C. Subharayulu Nayudu	Do. do.	
474	M. Alagiyasingala Chari	Do. do.	
475	N. Appadurai Mudaliyar	Do. do.	
476	F. Taylor	Do. do.	
477	A. M. Gunther	Do. do.	
478	*T. A. Monisse*	Do. do.	
	1876.		
479	C. Shanmukha Mudaliyar ..	Taluk Overseer	Passed from the 1st Dept.
480	H. Coghlan	Supervisor	R.E. Officers' prize; 1st prize for Mathcs., Eng. and Survg.; 2nd prize for Drawg.; prize for Telugu, and Principal's prize for monthly examination.
481	D. Venkataswami	Do.	1st prize for Drawing.
482	P. Panchapagesa Aiyar	Taluk Overseer	2nd prize for Mathcs.
483	C. H. R. Morton	Supervisor.	
484	P. Varadaraju	Do.	2nd prize for Eng.
485	C. Lawrence	Taluk Overseer.	

No.	Name.	Certificate.	Remarks.
486	G. Dwyer	Taluk Overseer.	
487	A. Venkataranga Rau	Do. do.	
488	C. Masilamani	Do. do.	
489	Bombr. S. Ainley, R. A.	Do. do.	
490	J. J. Crawley	Do. do.	Prize for Tamil.
491	C. W. Chinnappa Pillai	Do. do.	
492	S. T. Venkatapati	Do do.	
493	R. Gopala Aiyangar	Do. do.	
494	T. Somasundaram	Do. do.	
495	T. Kumaraswami Achari	Do. do.	
496	W. E. Johannes	Do. do.	
497	T. N. Rajaram Rau	Do. do.	
498	T. Enright	Do. do.	
499	S. Sambasiva Aiyar	Do. do.	
500	C. E. Stewart	Do. do.	
501	T. Krishnama Chari	Do. do	
502	C. W. McLeod	Do. do.	
503	Gunr. C. G. Barry, R. A.	Do. do.	
504	S. T. Venkatarama Aiyar	Do. do.	
505	M. Balarama Nayakar	Do do.	
506	S. N. Kuppuswami Aiyangar	Do. do.	
507	T. Appaswami Aiyangar	Do. do.	
	1877.		
508	*T. S. Seshadriachari*	Taluk Overseer.	
509	S. Sundara Sastri	Supervisor	R.E. Officers' prize; 1st prizes for Mathes. and Eng., and 2nd prize for Surv'g.
510	V. Subharaya Pillai	Do.	2nd prize for Eng.; 1st prizes for Survg. and Drawg., and 3rd prize for Mathes.
511	S. Rangaswami Aiyangar	Taluk Overseer	2nd prize for Drawg. and Principal's prize for monthly examination.
512	O. S. Subrahmanya Aiyar	Do. do.	2nd prize for Mathes.
513	T. Prakasa Mudaliyar	Do do.	
514	Sergt. G. E. Dove, Rl. Engrs.	Do. do.	Prize for Tamil.
515	R. Sundaram Aiyar	Do. do.	
516	G. Clendening	Do. do.	
517	C. J. Fonceca	Do. do.	
518	L. Aiyavu Pillai	Do. do.	
519	K. Sitrama Aiyar	Do. do.	
520	V. Subrahmanya Sastri	Do. do.	
521	M. R. Bresnaham	Do. do.	
522	J. R. Hendrick	Do. do.	
523	T. Sabhapati Mudaliyar	Do. do.	
524	T. Subharaya Mudaliyar	Do. do.	
525	V. Krishnaswami Mudaliyar	Do. do.	
526	E. L. Rebeiro	Do. do.	
527	E. S. Noronho	Do. do.	
528	E. Mahoney	Do. do.	
529	E. Krishna Aiyar	Do. do.	
530	N. Kumaraswami Achari	Do. do.	

Engineer Subordinates.

No.	Name.	Certificate.	Remarks.
531	A. A. Yagnaswami Dikshitar	Taluk Overseer.	
532	P. Donohoe	Do. do.	
	1878.		
533	*M. Muttuvira Pillai*	Taluk Overseer.	
534	*A. Tirumalraya Mudaliyar*	Do. do.	
535	T. Govinda Menon	Do. do.	Passed from the 1st Dept.
536	A. W. J. Tims	Supervisor	R. E. Officers' prize; 1st prizes for Survg. and Drawg. and Principal's prize for monthly examination.
537	V. L. Subrahmanya Aiyar	Overseer	2nd prize for Surveying.
538	S. K. Ramachandra Sastri	Supervisor	2nd prize for Mathcs. and 1st prize for Eng.
539	T. Govindaraja Mudaliyar	Do.	1st prize for Mathcs.
540	C. Raghunatha Sing	Do.	
541	J. B. Rodrigues	Overseer.	
542	V. Subrahmanya Aiyar	Do.	
543	R. Gopalaswami Aiyangar	Do.	2nd prize for Engr.
544	S. Subrahmanya Aiyar	Do.	
545	V. S. Vaidyanatha Mudaliyar	Do.	
546	R. Chakrapani Rau	Do.	
547	N. Narasimha Aiyangar	Do.	
548	T. Venkatarama Aiyar	Do.	
549	B. Kannayya Lal	Do.	
550	A. Raman Menon	Do.	2nd prize for Drawing.
551	C. E. Adolphus	Do.	1st prize for Language.
552	J. A. Sydenham	Do.	2nd prize for Language.
553	M. L. Arogyaswami Mudaliyar	Do.	
554	K. Krishna Rau	Do.	
555	C. H. Marrow	Do.	
556	Pte. T. Reardon, 89th Regt.	Do.	
557	V. Arumukha Mudaliyar	Do.	
558	J. B. Small	Do.	
559	C. R. Visvanatha Aiyar	Do.	
560	*T. Ramaswami Pillai*	Do.	
561	*P. Ramabrahmam Sastri*	Do.	
	1879.		
562	*P. R. Muttuswami Aiyar*	Overseer.	
563	N. Ramaswami Aiyar	Do.	Passed from the 1st Dept.
564	R. A. Bhagya Mudaliyar	Supervisor	R.E. Officers' prize; 2nd prizes for Mathcs. and Survg., 1st prize for Drawg.; and Principal's prize for monthly examination.
565	V. Narayanaswami Aiyar	Do.	1st prize for Engr.
566	H. Lander	Overseer	1st prize for Surveying.
567	K. K. Pattabhirama Aiyar	Do.	1st prize for Mathcs.
568	S. Ponnuswami Pillai	Do.	
569	V. Govinda Mudaliyar	Do.	2nd prize for Drawing.

No.	Name.	Certificate.	Remarks.
570	P. K. Vaidyanatha Aiyar	Overseer.	
571	R. E. Sherard	Do.	2nd prize for Engr.
572	A. Rangaswami Pillai	Do.	
573	C. Singaravelu Mudaliyar	Do.	
574	C. S. R. Duraiswami Aiyangar	Do.	
575	T. G. Venkata Rau	Do.	
576	D. Narayanaswami Aiyar	Do.	
577	V. Manikka Pattar	Do.	
578	T. Babu Rau	Do.	
579	K. Arunachala Sastri	Do.	
580	V. A. Srinivasa Sastri	Do.	
581	J. C. Campbell	Do.	Prize for Language.
582	C. E. S. Gopalaswami Aiyangar	Do.	
583	N. Gnanaprakasam	Do.	
584	V. M. Vridhagiri Mudaliyar	Do.	
585	K. G. A. Vaidyanatha Aiyar	Do.	
586	S. K. Ramayya Nayudu	Do.	
587	M. Venkatarama Sastri	Do.	
588	C. Subharaya Pillai	Do.	
589	*C. Appaswami Aiyar*	Do.	
590	*A. Amirtam Aiyar*	Do.	
591	*C. Varadachari*	Do.	
	1880.		
592	A. S. Narayana Aiyar	Overseer	Passed from the 1st Dept.
593	L. A. Rangaswami Aiyar	Supervisor	R.E. Officers' prize; prize for Mathcs.; 1st prizes for Eng. and Survg., and 2nd prize for Drawing.
594	S. Raghava Aiyangar	Do.	Prize for Mathcs. and prize for Session Work.
595	V. P. Ramaswami Aiyar	Do.	2nd prizes for Eng. and Survg. and 1st prize for Drawing.
596	T. N. Subrahmanya Aiyar	Do.	
597	S. Panchanada Aiyar	Overseer.	
598	P. Moses	Do.	
599	P. Srinivasa Aiyar	Do.	
600	B. Vaikunta Balija	Do.	
601	L.-Corpl. S. Hearne, 14th Hussars	Do.	
602	S. V. Gnanamuttu	Do.	
603	V. Viraswami Aiyangar	Do.	
604	C. N. Subramanya Aiyar	Do.	
605	V. Aravamudu Aiyangar	Do.	
606	S. Subrahmanya Aiyar	Do.	
607	M. Srinivasaga Pillai	Do.	
608	B. V. Abraham	Do.	
609	C. Venkataramayya Nayudu	Do.	2nd prize for Drawing.
610	L. S. Sabhapati Aiyar	Do.	
611	C. J. Lears	Do.	
612	G. Eapen	Do.	
613	K. Parthasarathi Aiyangar	Do.	
614	M. A. Tirunarayana Chari	Do.	
615	C. Subharaya Aiyar	Do.	

Engineer Subordinates.

No.	Name.	Certificate.	Remarks.
616	L.-Corpl. H. Slaney, 1/21 R. S. Fuslrs.	Overseer.	
		Do.	
617	Sergt. J. H. Ulyett, 43rd L. I.	Do.	
618	Gunr. L. Donaghue, R. A.	Do.	
	1881.		
619	Ag. Bombr. J. Cherry, R. A.	Supervisor	R.E. Officers' prize ; 1s prizes for Survg. an Drawg. and 2nd priz for Eng.
620	C. S. Srinivasa Aiyar	Do.	1st prizes for Mathc and Eng., and 2nd priz for Surveying.
621	H. E. La Fontaine	Overseer.	
622	K. Venkatareddi Nayudu	Do.	
623	C. Venkataramayya	Do.	
624	S. Bhavani Rau	Do.	2nd prize for Mathema tics.
625	Trumpr. J. W. Walsh, R. A.	Do.	
626	P. Narasimha Rau	Do.	
627	T. Venkataramanayya	Do.	2nd prize for Drawing.
628	Ag. Bombr. T. G. Blake, R. A.	Do.	
629	M. Y. Manikka Nayakar	Do	
630	V. Gangayya	Do.	
631	J. A. Masilamani	Do.	
632	S. Abraham	Do.	
633	M. A. Appla Chari	Do.	
634	*A. C. Sivaswami Aiyar*	Do.	
	1882.		
635	Ag. Bombr. A. Donaghue, R. A.	Overseer	R.E. Officers' prize prizes for Drawg. an Eng.
636	Gunr. J. Richardson, R. A.	Do.	Prizes for Mathcs. an Survg.
637	Ag. Bombr. D. Healey, R. A.	Do.	
638	Corpl. W. Rule, R. A.	Do.	Prize for Language.
639	A. Tirumalai Mudaliyar	Do.	
640	Driv. T. Turner, R. A.	Do.	
641	C. T. Mohan Sing	Do.	
642	*P. L. Ramachandra Aiyar*	Do.	
	1883.		
643	Gunr. C. Coghlan, Rl. H. Art.	Supervisor	R.E. Officers' prize a prize for Drawg.
644	Gunr. J. Alford, R. A.	Do.	Prizes for Survg. a Language.
645	H. Subhu Rau	Do.	Prizes for Mathcs. a Eng.
646	C. H. Edwards	Do.	
647	M. P. B. Narasimha Aiyangar	Do.	
648	N. Venkatadri Nayudu	Overseer.	
649	A. Ramamurti	Do.	
650	M. Aiyannah Nayudu	Do.	
651	D. G. Thomas	Do.	
652	P. Duncan	Do.	

No.	Name.	Certificate or Diploma.	Remarks.
653	S. G. Krishnaswami Aiyar	Overseer	Passed from the 1st Dept.
	1884.		
654	V. R. Venkatarama Aiyar	Supervisor	R.E. Officers' prize, and prizes for Mathcs.
655	T. Krishnaji Vasudev	Do.	Prize for Language.
656	S. L. Abraham	Do.	Prize for Survg. and Drawg.
657	Driv. E. Huson, Rl. H. Art.	Do.	
658	S. R. Subrahmanya Aiyar	Do.	Prize for Engineering.
659	T. S. Venkateswara Aiyar	Do.	
660	T. Perayya Nayudu	Do.	
661	K. Murugesa Mudaliyar	Do.	
662	C. R. Hari Hara Subba Aiyar	Overseer.	
663	H. W. Woods	Do	
664	Gunr. W. Lewis, Rl. H. Art	Do.	
665	P. M. Appadurai Aiyar	Do.	
666	S. Ranganayakulu Nayudu	Do	
667	S. A. Raghava Aiyar	Do.	
668	A. Venkataratna Pantulu	Do.	
669	S. V. Ramasawmi Aiyangar	Do	
670	K. R. Ranga Chariar	Do	
671	J. P. Andrade	Do.	
672	P. T Balakrishna Aiyar	Do.	
	1885.		
673	Pte. W. H. Goddard, Somt. L.I.	Supervisor	R.E. Officers' prize; prizes for Mathcs., Eng., Survg. and Drawg.
674	Pte. J. Ruck, S. W. Bordrs.	Do.	
675	Gunr. T. Murphy, R. A	Do	
676	A. Vedanta Chariar	Do.	
677	P. Ananda Rau	Do.	
678	V. S. Sundra Aiyar	Do.	
679	K. V. Kuriyan	Do.	
680	C. A. A. Hicken	Overseer.	
681	T. A. Srinivasa Aiyar	Do.	
682	C. Ramaswami Aiyar	Do.	
683	K. Rajagopala Aiyar	Do	
684	H. F Scott	Do.	
685	W. Ethiraja Mudaliyar	Do.	Prize for Language.
686	T. Abboy Aiyah	Do.	
687	S. Manikka Mudaliyar	Do.	
688	C. Dhairyanatha Mudaliyar	Do.	
689	M. O. Singara Aiyangar	Do.	
690	G. Currie	Do.	
691	C. I. Joseph	Do.	
692	N. Swaminatha Aiyar	Do.	

Engineer Subordinates.

No.	Name.	Certificate or Diploma.	Remarks.
693	A. Vedamuttu Pillai	Overseer.	
694	K. S. Vaidyanatha Aiyar	Do.	
695	Corpl. W. J. Moore, Somt. L. I.	Do.	
696	A. B. Power	Do.	
697	M. R. Barretto	Do.	
698	J. E. F. Vas	Do.	
	1886.		
699	Corpl. W. L. Emery, R. S. Fuslrs.	Supervisor	R.E. Officers' p prizes for Mathc Survg.
700	M. V. Krishnaswami Aiyar	Do.	
701	L.-Corpl. B. Reynolds, 12th Rl. Lancers.	Do.	Prizes for Engine and Drawg.
702	A. V. Krishna Menon	Do.	
703	L.-Corpl. P. King, Hamp. Regt.	Do.	
704	E. C. M. Mascarenhas	Do.	
705	Gunr. J. Knox, Rl. H. Art.	Do.	
706	G. Padmanabha Aiyar	Do.	
707	A. Narayanaswami Nayudu	Do.	
708	J. M. Gnanaprakasa Pillai	Do.	
709	L.-Corpl. J. W. Jones, Hamp. Regt.	Overseer.	
710	L. A Barboza	Do.	
711	K. S. Sankarasubha Annavi	Do.	
712	A. B. Colkers	Do.	
713	A. Kuppusawmi Aiyar	Do.	
714	A. V. Parasurama Aiyar	Do.	
715	K. Subha Rau	Do.	
716	S. Panchapagesa Aiyar	Do.	
717	G. W. Selvadurai	Do.	
718	T. Ramanjulu Chetti	Do.	
719	V. Ramakrishnayya	Do.	Prize for Langu
720	M. S. Krishnaswami Aiyar	Do.	
721	T. S. Lakshmana Rau	Do.	
722	*M. T. Ranga Ramanujayya*	Do.	
	1887.		
723	S. Gopala Chari	Overseer	Passed fro Engineer C
724	S. Sivagnana Mudaliyar	Do.	
725	C. R. Srinivasa Aiyangar	Do.	
726	Mahammad Sikandar	Supervisor	R.E. Officers' prizes for and Survg.
727	Corpl. F. W. Cornwell, 2nd R. F.	Do.	Prize for Lang
728	A. V. Krishnaswami Pillai	Do.	
729	S. Venkataratnam	Do.	

No.	Name.	Certificate or Diploma.	Remarks.
730	W. P. Clay	Overseer	Prize for Engineering.
731	T. S. Muttuswami Sastri	Do.	
732	A. Dasappa Aiyar	Do.	
733	A. Ghantayya	Do.	
734	D. Swaminatha Aiyar	Do.	
735	V. Krishnaswami Aiyar	Do.	
736	A. P. Doll	Do.	
737	C. V. Aiyaswami Aiyar	Do.	
738	S. Sivarama Aiyar	Do.	
739	F. A. Pope	Do.	Prize for Drawing.
740	A. V. Ranganatha Mudaliyar	Do.	
741	A. S. David	Do.	
742	S. A. Daivasikhamani Mudaliyar.	Do.	
743	K. Parthasarathi	Do.	
744	M. Buchiraju	Do	
745	C. Srinivasa Raghava Chari	Do.	
746	E. H. Muller	Do.	
747	T. Jacob	Do.	
748	C. Arunachala Pillai	Do.	
749	P. K. Swaminatha Pillai	Do.	
750	S. A. Fullinfaw	Do.	
751	K. P. Sivasankara Pillai	Do.	
752	*S. Punnavanam Pillai*	Do.	
753	*M. S Swaminatha Aiyar*	Do.	
754	*V. S. Gnanaprakasa Pillai*	Do.	
	1890.*		
755	U. Venkata Rau	Engineer Subordinate, 2nd Class.	Gold medal. Prizes for Engineering, Survg. and Drawg.
756	G. Narayana Rau	Do do.	Prize for Mathematics
757	G. Srinivasa Aiyangar	Do. do.	
758	A. Arulanandam Pillai	Do. do.	
759	Sergt. E. Price, 7th Hussars	Do. do.	Prize for Gymnastics.
760	L. S. Panchapakesa Sarma	Do do.	
761	M. R. Subrahmanya Aiyar	Do. do.	
762	P. V. Ramaswami Aiyar	Do. do	
763	C. J. Plummer	Do. do.	
764	P. M. Swaminatha Aiyar	Do. do.	
765	T. Venkatarama Aiyar	Do. do.	
766	P. Sivasubrahmanya Pillai	Do. do.	

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* *Note.*—Owing to the introduction of revised rules, extending the theoretical course to two-and-a-half years, and adding a practical course of two years, the class succeeding that of May 1887 passed the final examination of December 1888, and received diplomas only on the completion of the practical course. They therefore appear under the heading "1890."

Engineer Subordinates.

No.	Name.	Diploma.	Remarks.
	1891.		
767	C. J. Mani	Engineer Subordinate, 2nd Class.	Silver medal. Prizes for Mathcs. and Engineering, Survg. and Drawg.
768	C. L. Venkatanarasayya	Do. do.	
769	*P Subrahmanya Aiyar*	Do. do.	
	1892.		
770	Pte. G. E. Brand, 7th Hussars ..	Engineer Subordinate, 1st Class.	Silver medal. Prizes for Mathcs., for Engineering, for Survg. and Drawg. and for Workshop Practice. Roger's prize.
771	L.-Sergt. C. J. Smith, Oxfordshire L. I.	Engineer Subordinate, 2nd Class.	Prize for Vern. Lang.
772	W. T. J. Scanlon	Do. do.	
773	M. S. Venkatarama Aiyar ..	Do. do.	
774	T. A. Kuppuswami Aiyar ..	Do. do.	
775	*P. Ramachandra Aiyar*	Do. do ..	Passed from the Engineer Class.
	1893.		
776	S. Dakshanamurti	Engineer Subordinate, 2nd Class.	Prize for Mathematics.
777	P. N. Ramachandra Aiyar ..	Do. do. ..	Prize for Workshop Practice.
778	J. S. Mullen	Do. do.	
779	S. Iswara Sastri	Do. do.	
780	D. S. Sankara Aiyar	Do. do.	
781	Private C. H. Briant, Middlesex Regiment.	Do. do.	
782	E. T. Jordon	Do. do.	
783	M. Ramaswami Pillai	Do. do.	
	1894.		
*784	Corpl. G. Blake, 21st Hussars ..	Engineer Subordinate, 1st Class.	Silver medal. Prizes for Engineering, for Survg. and Drawg. Rogers' prize.
785	N. Tiruvambala Pillai	Engineer Subordinate, 2nd Class.	Silver medal. Prizes for Mathcs., for Eng. and Survg. Rogers' prize.
786	S. Chittambala Pillai	Do. do. ..	Prize for Gymnastics.
787	K. Srinivasa Aiyar	Do. do.	

Corpl. G. Blake passed the final examination in December 1891.

No.	Name.	Diploma.	Remarks.
788	L.-Corpl. J.O'C. Phelan, 2nd Suffolk Regiment.	Engineer Subordinate, 2nd Class.	
789	D. V. Venkatarama Aiyar	Do. do.	Prize for Language.
790	C. V. Shanmukha Mudaliyar	Do. do.	
791	V. S. Srinivasa Aiyangar	Do. do.	
792	M. G. Singarachari	Do. do.	
793	K. P. Vaidyanatha Aiyar	Do. do.	
	1895.		
794	M. R. Natesa Aiyar	Engineer Subordinate, 2nd Class.	Silver medal. Prize for Engineering. Rogers' prize.
795	M. S. Narayanaswami Aiyar	Do. do.	Prize for Language.
796	N. Kandaswami Pillai	Do. do.	
797	M. N. Ramakrishna Aiyar	Do do.	
798	T. S. Narayanaswami Aiyar	Do. do.	
799	Gunner M. Power, Rl. Art.	Do. do.	
800	M. K. Kesava Pillai	Do. do.	
801	R. Panchapakesa Aiyar	Do. do.	Prize for Surveying.
802	P. Seshachari	Do. do.	
803	K. R. Ganapati Aiyar	Do. do.	
804	V. S. Rangaswami Aiyar	Do. do.	
805	Corporal H. A. Furnell, 2nd Suffolk Regt.	Do. do.	Prize for Drawing, and for Drills and exercises.
806	L. D. Ramachandra Aiyar	Do. do.	Prize for Mathematics.
807	U. R. Bashyam Aiyangar	Do. do.	
808	T. S. Rangaswami Aiyar	Do. do.	
809	E. King	Do. do.	
810	C. J. Rangaswami Aiyangar	Do. do.	
811	A. Manicka Mudaliyar	Do. do.	
812	P. S. Natesa Sastri	Do. do.	
813	J. A. David	Do. do.	
814	A. Rama Rau	Do. do.	Prize for Workshop Practice.
815	P. Rangaswami Aiyangar	Do. do.	
816	S. Natesa Aiyar	Do. do.	Prize for Workpshop Practice.
817	T. V. Saptarishi Sastri	Do. do.	
818	K. N. Raman Pillai	Do. do.	
819	R Srinivasa Raghava Aiyangar	Do. do.	

LIST of Persons who have been awarded Certificates of qualification as DRAFTSMEN on the results of Examinations held in connection with the College of Engineering, Madras.

(Note.—Names shown in italics are those of independent candidates; all others are those of College students.)

No.	Name.	Certificate.	Remarks.
	1859.		
1	W. Narasimhulu Nayudu	Draftsman, 3rd Class.	
2	P. Raghavulu	Draftsman.	
3	Munuswami Achari	Do.	
4	V. Jagannatham	Do. 2nd Class	
5	C. Ramaswami Nayudu	Do. do.	
6	William Donaghue	Do. do.	
7	S. Tirumal Rau	Do. do.	
8	V. Singaravelu	Do. do.	
9	T. Nadamuni	Do. 3rd Class	
10	T. J. Rangasayi Nayudu	Do 1st ,,	
11	P. Muttuswami Mudaliyar	Do. 3rd ,,	
12	D. O'Dogherty	Do. 2nd ,,	
13	C. Arumukha Mudaliyar	Do. 3rd ,,	
14	N. Kuppuswami Mudaliyar	Do. 4th ,,	
15	P. Muttuswami Nayudu	Do. do.	
16	M. Vaidyalinga Mudali	Do. 3rd Class.	
17	M. Rajagopal Nayak	Do. 4th ,,	
18	A. Vadivelu Mudaliyar	Do. do.	
19	M. Shanmukha Mudaliyar	Do. 3rd Class.	
20	P. Gurunatha Mudali	Do. 4th ,,	
21	T. Kuppuswami Mudali	Do. do	
22	C. Sundara Mudali	Do. do.	
23	S. Rangaswami Mudali	Do. do.	
24	M. Devaraja Mudali	Do. 3rd Class.	
25	M. Saravana Mudali	Do. 4th ,,	
26	A. M. Rudrappa Nayadu	Do. 3rd ,,	
	1860.		
27	P. Singaravelu Chetti	Draftsman, 3rd Class.	
28	C. Venkatapati Raju	Do. 4th ,,	
29	D. Sinclair	Do. 3rd ,,	
30	P. Vasudeva Mudali	Do. 2nd ,,	
31	C. Venkatrayulu Raju	Do. 3rd ,,	
32	P. Krishnama Raju	Do. do.	
33	T. Raghavulu Nayudu	Do. do.	
34	P. Tyagaraya Mudali	Do. 4th Class.	
35	T. Ekambara Mudali	Do. do.	

Draftsmen.

No.	Name.	Certificate.	Remarks.
36	N. Viraswami Aiyar	Draftsman, 4th Class.	
37	I. Murugesa Mudali	Do. do.	
38	P. Narayanaswami Mudali	Do. 3rd Class.	
39	T. Krishnaswami Pillai	Do. 4th ,,	
40	P. W. Subhayya Nayudu	Do. do.	
41	P. Guruswami Nayudu	Do. 3rd Class.	
42	M. Munuswami Mudali	Do. do.	
43	T. J. Fitzgerald	Do. 2nd Class.	
44	A. Chatelier	Do. do.	
45	I. Ekambara Mudali	Do. 4th Class.	
46	J. C. Fowler	Do. 2nd ,,	
47	William Evans	Do. 1st ,,	
48	J. Beazley Brougham	Do. 2nd ,,	
49	K. Varadarajulu Nayudu	Do. 3rd ,,	
50	P. Muttuswami Mudaliyar	Do. 2nd ,,	
51	M. Gnanamuttu Pillai	Do. do.	
52	P. Annadurai Pattar	Do. do.	
53	C. Manikkam	Do. 3rd Class.	
54	T. Govindarajulu Mudaliyar	Do. do.	
55	N. Murugesa Mudaliyar	Do. 2nd Class.	
56	P Arunachalam	Do. do.	
57	D. Stephens	Do. 1st Class.	
58	G. Crawford	Do. 2nd ,,	
59	S. P. Rangaswami Mudaliyar	Do. 3rd ,,	
60	M. Munuswami Mudaliyar	Do. 2nd ,,	
61	M. Periaswami Mudali	Do. 3rd ,,	
62	T. Venkatasa Mudaliyar	Do. do.	
63	A. M. Rudrappa Nayudu	Do. 2nd Class.	
64	P. Kumaraswami Mudaliyar	Do. 3rd ,,	
65	M. Vasudeva Mudaliyar	Do. do.	
66	T. Tyagarajulu	Do. 2nd Class.	
67	C. Raghavulu Nayudu	Do. do.	
	1861.		
68	P. W. Subhayya Nayudu	Draftsman, 3rd Class.	
69	C. Tiruvenkata Chariar	Do. do.	
70	C. Lakshmanaswami Mudali	Do. 2nd Class.	
71	M. Balasundara Nayak	Do. 3rd ,,	
72	M. Saravana Mudali	Do. 2nd ,,	
73	C. Krishnaswami Nayudu	Do. 3rd ,,	
74	M. Nallatambi Pillai	Do. 2nd ,,	
75	T. M. Palaniyandi Pillai	Do. 3rd ,,	
76	J. Chengalvaraya Raju	Do. do.	
77	C. Manikkam	Do. 2nd Class.	
78	Joseph Jewis	Do. do.	
79	M. Ramaswami Mudaliyar	Do. do.	
80	Charles Hodgson	Do. do.	
81	S. Rangaswami Mudaliyar	Draftsman and Estimator, 2nd Class.	

No.	Name.	Certificate.	Remarks.
	1862.		
82	C. Kannayya Nayudu	Draftsman and Estimator, 2nd Class.	
83	B. C. Edwards	Do. do.	
84	T. Krishnaswami Chetti	Do. do.	
85	C. Chokkalinga Mudali	Do. do.	
86	B. Edwards	Do. 1st Class.	
87	V. Govindarajulu	Do. 2nd ,,	
88	Parankusa Nayudu	Do. do.	
89	C. Venkatarayulu Raju	Do. do.	
90	H. Davies	Do. do.	
91	C. Raghavulu Nayudu	Do. 3rd Class.	
92	J. Padmanabha Nayudu	Do. do.	
93	M. Vasudeva Mudaliyar	Do. 2nd Class.	
94	Michael D'Rozario	Do. do.	
	1863.		
95	P. Parankusa Nayudu	Draftsman and Estimator, 1st Class.	
96	Y. Arumukham	Do. do.	
97	T. Krishnaswami	Do. do.	
98	C. Vedachala Mudaliyar	Do. 2nd Class.	
99	John Jackson	Do. do.	
100	C. Krishnaswami Nayudu ..	Do. do.	
101	J. Wallan	Do. do.	
102	P. Ratna Mudaliyar	Do. 3rd Class.	
103	C. Saravanavelu Mudali	Do. do.	
104	P. W. Subhayya Nayudu ..	Do. 2nd Class.	
105	T. Rajaram Pillai	Do. do.	
106	K. Parthasarathi Nayudu ..	Do. do.	
107	A. Narayanaswami	Do. 3rd Class.	
108	B. Munuswami Chetti	Do. 2nd ,,	
109	C. Raghavulu Nayudu	Do. do.	
110	W. Booth	Do. 3rd Class.	
	1864.		
111	N. M. Ettirajulu Mudali	Draftsman and Estimator, 2nd Class.	
112	S. R. Govinda Rau	Do. 3rd ,,	
113	P. Ratna Mudaliyar	Do. 2nd ,,	
114	M. [illegible] Rangaswami Pillai.. ..	Do. 1st ,,	
115	A. Kuppuswami Mudaliyar ..	Do. 2nd ,,	
116	P. Shanmukha Chetti	Do. do.	
117	T. Lefebour	Do. do.	
118	P. Lokanatha Mudali	Do. do.	
119	C. Venkatasubhayya	Do. 1st Class.	
120	C. Krishnaswami Nayudu ..	Do. do.	

Draftsmen.

No.	Name.	Certificate.	Remarks.
121	D. Ramanna Nayudu	Draftsman and Estimator, 1st Class.	
122	S. K. Govinda Rau	Do. 2nd Class.	
123	C. McDiarmid	Do. do.	
124	T. M. Viraswami Nayudu	Do. 3rd Class.	
125	John Bourke	Do. do.	
126	T. Sitarama Mudali	Do. do.	
	1865.		
127	F. D'Souza	Draftsman and Estimator, 2nd Class.	
128	T. M. Viraswami Nayudu	Do. do.	
129	Duraiswami Nayudu	Do. 3rd Class.	
130	A. Walter	Do. 2nd ,,	
131	John Coghlan	Do. do.	
132	P. Narasimha Rau	Do. 1st Class.	
133	Parscal Lewis Druem	Do. do.	
134	P. Lakshmayya	Do. 2nd Class.	
135	P. Rajagopala Nayudu	Do. do.	
136	C. Murugesa Mudaliyar	Do. do.	
137	V. Thandavarayan	Do. do.	
138	T. Tiruvenkatam	Do. do.	
139	C. Venkataperumal	Do. 3rd Class.	
140	V. Sadasiva Mudaliyar	Do. 1st ,,	
	1866.		
141	S. Babu Nayudu	Draftsman and Estimator, 1st Class.	
142	*D. Carlier*	Do. 2nd ,,	
143	*C. Sakaram Rau*	Do. 3rd ,,	
144	*K. Parthasarathi Nayudu*	Do. 1st ,,	
145	*D. Venkataratnam*	Do. 2nd ,,	
146	*Francis*	Do. do.	
147	*C. Nagayya*	Do. do.	
	1867.		
148	*C. Manikkam*	Draftsman and Estimator, 1st Class.	
149	*P. Singaravelu Mudaliyar*	Do. 2nd ,,	
150	*Venkataperumal*	Do. do.	
151	*D. Haimsing*	Do. do.	
152	*C. Sakaram Rau*	Do. do.	
153	*T. M. Viraswami Nayudu*	Do. 1st Class.	
154	C. Fitzgerald	Do. do.	
155	J. Smith	Do. do.	
156	A. Appadurai Aiyar	Do. 2nd Class.	
157	*P. S. Aurunachala Mudaliyar*	Do. do.	

No.	Name.	Certificate.	Remarks
158	*N. Ettirajulu Mudaliyar*	**Draftsman and Estimator, 1st Class.**	
159	*P. Appaswami*	Do. do.	
160	*P. Arunachalam*	Do. do.	
161	*V. Krishnaswami Mudali*	Do. do.	
162	*J. M. Lewis*	Do. do.	
163	*M. Srikrishnulu Nayudu*	Do. do.	
164	*S. Jackson*	Do. do.	
165	*V. Thandavaraya Mudali*	Do. do.	
166	*T. Manikkam*	Do. 2nd Class.	
167	*P. Muttuswami Mudali*	Draftsman, 1st Class.	
168	*P. Lakshmayya Nayudu*	Do. do.	
169	*P. Sivapatha Mudaliyar*	Do. 2nd Class.	
170	*P. Subharaya Mudaliyar*	Do. 3rd Class.	
	1868.		
171	*C. T. A. Baldrey*	Draftsman and Estimator, 2nd Class.	
172	*C. Ramanjulu Nayudu*	Do. 3rd Class.	
173	*S. Ramayya*	Do. 2nd Class.	
174	*T. Raghavulu*	Do. do.	
175	*C. Murugesa Mudali*	Do. do.	
176	G. Vijayaraghavulu Chetti	Do. 1st Class.	1st prize.
177	T. Kandaswami	Do. do.	2nd prize.
178	E. Meneand	Do. do.	
179	C. Tirumalayya	Do. 2nd Class.	
180	L. Manikka Mudali	Do. do.	
181	P. Parthasarathi Nayudu	Do. do.	
182	E. M. Walter	Do. do.	
183	C. Nagaratnam	Do. do.	
184	J. Wilson	Do. 3rd Class.	
185	T. Narayanaswmi Pillai	Do. do.	
186	Abdul Ghafur Khan	Do. do.	
187	*V. Varadarajulu Mudali*	Do. 2nd Class.	
188	*T. Manikka Mudali*	Do. 1st Class.	
189	*T. Tiruvenkata Mudali*	Do. do.	
190	*C. Raghavulu Nayudu*	Do. do.	
191	*B. Narasimhulu Nayudu*	Do. 2nd Class.	
192	*P. Subharaya Mudali*	Do. do.	
193	*P. Chidambara Mudali*	Do. do.	
194	*M. Chennakesavulu Nayudu*	Do. do.	
195	*V. Singaravelu Mudali*	Do. do.	
	1869.		
196	*A. Perianayagam*	**Draftsman and Estimator, 1st Class.**	
197	*M. Rangaswami*	**Do. do.**	

Draftsmen.

No.	Name.	Certificate.	Remarks.
198	*A. L. Tambuswami*	Draftsman and Estimator, 1st Class.	
199	*G. Papayya*	Do. 2nd Class.	
200	*S. Ramanujam*	Do. 3rd Class.	
201	*B. Andiyappan*	Do. do.	
202	*P. Viraswami*	Do. 2nd Class.	
203	C. Ponnarangam	Do. 1st Class.	
204	Abdul Ghafur Khan	Do. do.	
205	T. Narayanaswami Pillai	Do. 2nd Class.	
206	Somasundaram	Do. do.	
207	J. Ratnasawmi	Do. do.	
208	T. Arunachala Aiyar	Do. do.	
209	J. Hayes	Do. do.	
210	P. Chinnaswami	Do. do.	
211	H. Briggs	Do. do.	
212	C. Varadachari	Do. 3rd Class.	
213	*T. Krishnaswami Nayudu*	Do. 1st Class.	
214	*V. Varadarajulu Mudali*	Do. do.	
215	*A. L. Tambuswami*	Do. 2nd Class.	
216	*S. M. Ettirajulu Nayudu*	Do. 3rd Class.	
217	*J. Wilson*	Do. 1st Class.	
218	*V. Murugesa Mudaliyar*	Do. do.	
219	*R. Gopal Reddi*	Do. 2nd Class.	
220	*T. Narasimhulu Nayudu*	Do. do.	
221	*M. Rangaswami Pillai*	Do. do.	
222	*A. Srinivasulu Nayudu*	Do. 3rd Class.	
223	*J. C. Ramayyan*	Do. do.	
224	*T. I. Ramanjulu Nayudu*	Do. 2nd Class.	
	1870.		
225	*C. Narayanayya*	Draftsman and Estimator, 3rd Class.	
226	*M. Appaswami Rau*	Do. do.	
227	*Thomas Francis*	Do. do.	
228	*M. Ramanjulu Nayudu*	Do. 2nd Class.	
229	*Bhavani Sing*	Do. do.	
230	*A. Muttuswami Mudaliyar*	Do. 3rd Class.	
231	C. Subrahmanyam	Do 1st Class.	1st prize.
232	M. Saravanam	Do. 2nd Class.	
233	T. Kuppuswami	Do. do.	2nd prize.
234	R. Ramanujam	Do. do.	
235	C. Venkatesan	Do. 3rd Class.	
236	D. Donovan	Do. do.	
237	T. Gerrard	Do. do.	
238	T. Govindarajulu	Do. do.	
239	C. V. Sitaramayya	Do. do.	
240	*C. Ramaswami Rau*	Do. do.	
241	*K. Varadarajulu*	Do. 2nd Class.	

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No.	Name.	Certificate.	Remar
242	*C. Varadachari*	Draftsman and Estimator, 2nd Class.	
243	*P. V. Govindarau Nayudu* ..	Do. 3rd Class.	
244	*S. M. Ettirajulu Nayudu*	Do. 2nd Class.	
245	*C. Venkatachala Pillai*	Do. 3rd Class.	
246	*T. Perreire*	Do. 2nd Class.	
	1871.		
247	*W. B. Mason*	Draftsman and Estimator, 1st Class.	
248	*M. V. Ranganatha Pillai*	Do. do	
249	*K. Venkatachala Chetti*	Do. 2nd Class.	
250	*C. Subharaya Mudali*	Do. 1st Class.	
251	*P. Singaravelu Mudali* .. .	Do. do.	
252	B. Abboy Nayudu	Do. do. ..	1st prize.
253	M. Somasundara Mudaliyar ..	Do. do. ..	2nd prize.
254	S. Vijayaraghavulu Nayudu ..	Do. 2nd Class.	
255	F. W. Tyrell	Do. do.	
256	Muhammad Nizirullah Sahib ..	Do. do.	
257	E. Watson	Do. 3rd Class.	
258	A. Murugesa Mudali	Do. do.	
259	P. C. Devarajulu Nayudu ..	Do. do.	
260	*B. Vira Venkayya*	Do. 2nd Class.	
261	*C. Lakshmanaperumalu*	Do. do.	
262	*Charles McGrath*	Do. do.	
263	*A. M. Murugesa Mudali*	Do. do.	
264	*T. Tularam*	Do. do.	
265	*R. Govindaswami Pillai*	Do. 3rd Class.	
	1872.		
266	*V. Vadivelu Mudali*	Draftsman and Estimator, 3rd Class.	
267	*T. R. Sheshagiri Rau*	Do. 2nd Class.	
268	A. R. Piellow	Do. 1st Class. ..	1st prize.
269	C. Lakshmanan	Do. 2nd Class. ..	2nd prize.
270	R. Bland	Do. do.	
271	W. D. Wheeler	Do. do.	
272	P. Devarajulu Nayudu	Do. do.	
273	T. Subrahmanya Pillai	Do. 3rd Class.	
274	J. Guruswami Nayudu	Do. do.	
275	H. Wheeler	Do. do.	
276	*J. M. Samuel Pillai*	Do. 2nd Class.	
277	*W. R. Venkatachala Mudali* ..	Do. do.	
278	*A. Lokanatha Mudali*	Do. do.	
279	*M. A. Munuswmi Nayudu*	Do. do.	
280	*K. Varadarajulu*	Do. 1st Class.	

Draftsmen.

No.	Name.	Certificate.	Remarks.
	1873.		
281	*M. Appaswami Rau*	Draftsman and Estimator, 2nd Class.	
282	*C. Gantayya Nayudu*	Do. 1st Class.	
283	*V. Sriramulu*	Do. 3rd Class.	
284	*T. Manikka Mudali* . ..	Do. do.	
285	*M. Sonachala Pillai*	Do. do.	
286	R. E. Thomas	Do. 1st Class. ..	Passed from the Second Dept.
287	T. Subrahmanya Pillai	Do. 2nd Class. ..	2nd prize.
288	C. Seshachari	Do. do. ..	1st prize.
289	J. Gurusawmi Nayudu	Do. do.	
290	M. A. Munusawmi Nayudu ..	Do. do.	
291	C. Varadarajulu	Do. 3rd Class.	
292	A. Sivaramayya	Do. do.	
293	C. Munusawmi Pillai	Do. do.	
294	C. Satakopam	Do. do.	
295	*F. Hines*	Do. 2nd Class.	
296	*T. R. Cooper*	Do. 3rd Class.	
297	*J. Pereira*	Do. do.	
298	*M. Appaswami Rau*	Do. 1st Class.	
299	*M. Munuswami Rau*	Do. 3rd Class.	
300	*V. S. Muttukrishna Mudali* ..	Do. do.	
301	*M. S. Munuswami Mudali*	Do. do.	
302	*A. Bhagynanatha Pillai*	Do. do.	
303	*C. Raju Mudali*	Do. do.	
304	*B. Narasimhulu Nayudu*	Do. do.	
305	*J. Pereira*	Do. 2nd Class.	
	1874.		
306	*T. Perumal Nayudu*	Draftsman and Estimator, 2nd Class.	
307	*S. Ramanjulu Raju*	Do. do.	
308	*L. Paczensky*	Do. 3rd Class.	
309	*M. Ponnuswami Nayakan*	Do. do.	
310	*A. Kumaraswami Mudali*	Do. do.	
311	*T. R. Cooper*	Do. 2nd Class.	
312	S. Vijayaraghavulu Nayudu ..	Do. 1st Class.	
313	T. Raghavayya	Do. do.	
314	C. Kesava Chari	Do. do.	
315	T. Rudraswami Nayudu	Do. 2nd Class.	
316	A. N. Ettirajulu Mudali	Do. do.	
317	V. S. Swaminatha Mudali ..	Do. do.	
318	C. R. Kodandarama Aiyar ..	Do. do.	
319	F. Rencontre	Do. 3rd Class.	
320	A. Raman Menon	Do. do.	
321	M. C. Tangavelu	Do. do.	
322	P. Rangayya	Do. do.	
323	R. Venkata Rau	Do. do.	
324	S. Chidambara Pillai	Do. do.	

No.	Name.	Certificate.	Remarks.
325	S. Swaminatha Aiyar	Draftsman and Estimator, 3rd Class.	
326	Swami Pillai	Do. do.	
327	M. Balaji Sing	Do. do.	
328	W. Fonceca	Do. do.	
329	Zahid Khan Sahib	Do. do.	
330	*V. S. Muttukrishna Mudali*	Do. 2nd Class.	
331	*C. E. Paczensky*	Do. do.	
332	*M. P. Jacob*	Do. 3rd Class.	
333	*A. Duraiswami Mudali*	Do. do.	
334	*A. Munuswami Mudali*	Do. 1st Class.	
335	*J. S. Brito*	Do. 3rd Class.	
336	*P. Ponnuswami Pillai*	Do. do.	
337	*A. C. Murugesa Mudali*	Do. do.	
338	*M. S. Vaidyanatha Aiyar*	Do. do.	
339	*R. Venkataswami*	Do. do.	
340	*N. Venkatarangam Pillai*	Do. 2nd Class.	
341	*T. S. Govindaswami Pillai*	Do. 3rd Class.	
342	*T. Ponnuswami Pillai*	Do. do.	
343	*T. Seshachalam*	Do. do.	
344	*P. V. Raghavayya*	Do. do.	
345	*K. Chandrasekhara Rau*	Do. 2nd Class.	
	1875.		
346	*M. S. Vaidyanatha Aiyar*	Draftsman and Estimator, 2nd Class.	
347	*A. Bhagyanatha Pillai*	Do. do.	
348	*M. C. Tangavelu Mudali*	Do. do.	
349	*G. Tambuswami Pillai*	Do. 3rd Class.	
350	*I. Kannuswami Mudali*	Do. do.	
351	*Muhammad Raza*	Do. do.	
352	*Abdul Qadir*	Do. do.	
353	*K. Venkata Reddi*	Do. do.	
354	*M. Ranga Rau*	Do. do.	
355	*K. Venkanna*	Do. do.	
356	H. Srinivasa Rau	Do. 1st Class	Prize.
357	P. Shanmukha Mudaliyar	Do. do.	
358	John Pillai	Do do	
359	M. Rangaswami Nayakar	Do. do.	
360	R. Srinivasa Rau	Do. 3rd Class.	
361	Ghulam Qadir	Do. do.	
362	*A. R. Muttuswami Achari*	Do. do.	
363	*K. Narayanaswami*	Do. do.	
364	*H. Montgomery*	Do. do.	
	1876.		
365	*R. Srinivasa Rau*	Draftsman and Estimator, 2nd Class.	
366	*M. Govindarajulu Nayudu*	Do. 3rd Class.	

Draftsmen.

No.	Name.	Certificate.	Remarks.
367	*T. Mahalinga Achari*	Draftsman and Estimator, 3rd Class.	
368	*P. Murugesa Mudali*	Do. do.	
369	*K. Narasimharau Nayudu*	Do. do.	
370	*P. Balarama Nayudu*	Do. do.	
371	*S. Papayya Pantulu*	Do. do.	
372	C. Ratnam	Do. 2nd Class	1st prize.
373	B. Param Raju	Do. do.	2nd prize.
374	H. DeMonte	Do. 3rd Class.	
375	C. Muller	Do. do.	
376	P. Purushottama Raju	Do. do.	
377	J. Grogan	Do. do.	
378	T. Sambhu Rau	Do. do.	
379	T. Anbu Pillai	Do. do.	
380	T. Govindaswami Rau	Do. do.	
381	K. Subhayya	Do. do.	
382	C. Viraswami	Do. do.	
383	A. Darmalingam	Do. do.	
384	W. McLean	Do. do.	
385	A. Sundaram Aiyar	Do. do.	
386	P. Ramanjulu Naidu	Do. do.	
387	S. Vedamanikkam	Do. do.	
388	S. Daivasikhamani	Do. do.	
389	Zuhur Ali Beg	Do. do.	
390	*S. A. Arbhutham*	Do. do.	
391	*M. Ramaswami Nayudu*	Do. do.	
392	*Shaikh Tipu*	Do. do.	
393	*G. A. Grogan*	Do. do.	
394	*T Kuppuswami Pillai*	Do. do.	
395	*F. Hines*	Do. 1st Class.	
	1877.		
396	*G. Tambuswami Pillai*	Draftsman and Estimator, 2nd Class.	
397	*H. DeMonte*	Do. do.	
398	*R. Krishna Rau*	Do. 3rd Class.	
399	*N. A. Muttuswami Nayudu*	Do. do.	
400	*K. Venkataratnam*	Do. do.	
401	*C. Gnanaprakasam*	Do. do.	
402	*M. T. Adikesavulu*	Do. do.	
403	*V. A. Arbhutha Mudali*	Do. do.	
404	*T. Narasinga Rau*	Do. do.	
405	*P. Kuppuswami Mudali*	Do. do.	
406	*P. Vijayaranga Mudali*	Do. do.	
407	*S. Chidambara Pillai*	Do. 2nd Class.	
408	P. Murugesa Mudali	Do. do.	1st prize.
409	M. Kuppusami Achari	Do. do.	2nd prize.
410	P. Vijayaranga Mudali	Do. do.	
411	S. Ettirajayya	Do. 3rd Class.	

No.	Name.	Certificate.	Remarks.
412	C. Venkataswami Nayudu	Draftsman and Estimator, 3rd Class.	
413	R. Purushottama Aiyangar	Do. do.	
414	C. Krishnaswami Chetti	Do. do.	
415	J. Melson	Do. do.	
416	K. Lakshman Lal	Do. do.	
417	R. Chinnaswami Nayudu	Do. do.	
418	C. R. Srinivasa Aiyangar	Do do.	
419	E. Gopala Aiyar	Do. do.	
420	*T. Muttuswami Pillai*	Do. do.	
421	*C. Krishnaswami Pillai*	Do. do.	
422	*K. Narasimha Rau*	Do. 2nd Class.	
	1878.		
423	*C. Viraswami Achari*	Draftsman and Estimator, 2nd Class.	
424	*R. Sitaram Sing*	Do. 3rd Class.	
425	*A. Lakshminarayana*	Do. do.	
426	*V. Subhayya*	Do. do.	
427	*V. Munuswami Rau*	Do. 2nd Class.	
428	*K. A. Krishnama Chari*	Do. 3rd Class.	
429	*Henry Coghlan*	Do. 1st Class.	
430	A. C. Ramanuja Mudali	Do. 2nd Class	1st prize.
431	Samuel Charles Moss	Do. 3rd Class	2nd prize.
432	C. Munuswami Mudali	Do. do.	
433	T. R. Panchapagesa Rau	Do. 2nd Class.	
434	O. Ramakrishna Nayudu	Do. 3rd Class.	
435	A. Srinivasulu Nayudu	Do. do.	
436	M. Rangayya Nayudu	Do. do.	
437	T. Manikka Chetti	Do. do.	
438	John Henry Stevenage	Do. do.	
439	S. Singaravelu Mudali	Do. do.	
440	Samuel Mathias Lemos	Do. do.	
441	V. Sivaramakrishna Aiyar	Do. do.	
442	C. M. S. Duraiswami Pillai	Do. do.	
443	Dastgir Shams-ud-din	Do. do.	
444	T. M. Sadasiva Pillai	Do. do.	
445	S. Ramadas Nayudu	Do. do.	
446	A. Kadirvelu Mudali	Do. do.	
447	C. V. Chinnayya Mudali	Do. do.	
448	A. Ram Sing Takar	Do. do.	
449	E. Munuswami Pillai	Do. do.	
450	S. Krishnaswami Aiyar	Do. do.	
451	M. Alwar Nayudu	Do. do.	
452	K. Tandavakrishna Pillai	Do. do.	
453	R. Govindarau Mudaliyar	Do. do.	
454	G. Krishnabrahmam	Do. do.	
455	Alfred Israel Daniell	Do. do.	

Draftsmen.

No.	Name.	Certificate.	Remarks.
456	M. Ranga Rau	Draftsman and Estimator, 2nd Class.	
457	M. Nagaratna Nayakar	Do. 3rd Class.	
458	S. Daivasikhamani Mudaliyar	Do. 2nd Class.	
459	V. Subramanya Aiyar	Do. do.	
460	T. Ramalinga Pillai	Do. 3rd Class.	
461	T. Govindaswami Rau	Do. 2nd Class.	
	1879.		
462	M. Vasudeva Aiyar	Draftsman and Estimator, 1st Class	1st prize.
463	C. Munuswami Mudali	Do. 2nd Class	2nd prize.
464	C. Varadaraja Mudali	Do. 3rd Class.	
465	C. Raghavacharlu	Do. do.	
466	W. Ettirajulu Nayudu	Do. 2nd Class.	
467	N. Ponnuswami Nayakar	Do. 3rd Class.	
468	N. Krishnaswami Mudali	Do. do.	
469	M. Perumal Nayakar	Do. do.	
470	John Henry Duarte	Do. do.	
471	T. M Duraiswami Mudali	Do. do.	
472	E. Ratna Mudali	Do. do.	
473	N. Balasundara Mudali	Do. do.	
474	David Henry Lincoln	Do. do.	
475	Sayid Muhammad	Do. do.	
476	C. Vijayaranga Mudali	Do. do.	
477	Shaikh Mustafa	Do. do.	
478	*A. Duraiswami Mudaliyar*	Do. do.	
479	*S. Dhravyam Pillai*	Do. do.	
480	*P. Subrahmanya Aiyar*	Do. do.	
	1880.		
481	*S. Seshu Aiyar*	Draftsman and Estimator, 3rd Class.	
482	G. Narayanaswami Nayudu	Do. do.	1st prize.
483	R. Venkatesulu Nayudu	Do. do	2nd prize.
484	S. Nataraja Aiyar	Do. 2nd Class.	
485	P. Pushpanatha Pillai	Do. 3rd Class.	
486	S. Manikka Mudali	Do. do.	
487	C. Parthasarathi Mudali	Do. do.	
488	V. Vadivelu Mudali	Do. do.	
489	T. Krishnaswami Nayudu	Do. do.	
490	V. Ettirajulu Mudali	Do. do.	
491	R. Gopala Chari	Do. do.	
492	K. Adiseshayya	Do. do.	
493	V. Daivasikhamani Pillai	Do. do.	

Draftsmen.

No.	Name.	Certificate.	Remarks.
	1881.		
194	T. Visvanatha Mudali	Draftsman and Estimator, 2nd Class .	1st prize.
195	A. Ramaswami Mudali	Do. do. ..	2nd prize.
196	V. Umapati Mudali	Do. do.	
197	R. Aiyaswami Aiyar	Do. do.	
198	C. Rajagopala Nayudu .. .	Do. do	
199	P. Devaraja Mudali	Do. 3rd Class.	
500	S. Ganesa Aiyar	Do. do.	
501	L. Kesavulu Nayudu	Do. do.	
502	N. Rangayya Nayudu	Do. do.	
503	C. Velayuda Nayakar	Do. do.	
504	M. Rajaratna Nayakar	Do. . do.	
505	K. Kolandavelu Mudali	Do. do.	
	1882.		
506	*Henry DeMonte*	Draftsman and Estimator, 1st Class.	
507	G. Narayanaswami Nayudu ..	Do. do.	
508	H. Egna Lal	Do. 2nd Class.	
509	S. Munuswami Nayudu	Do. do.	
510	George Ellis	Do. 3rd Class ..	Prize.
511	A. Sundaranatha Pillai	Do. do.	
512	V. Parthasarathi Mudali ..	Do. do.	
513	K. Srinivasulu Mudali	Do. do.	
514	*A. Sivaramayya*	Do. 2nd Class.	
515	*S. Virabhadrayya*	Do. do.	
516	*R. F. Fletcher*	Do. do.	
517	*P. Shanmukha Mudaliyar*	Do. 1st Class.	
518	*G. Tambuswami Pillai*	Do. do.	
519	*P. Duraiswami Nayudu*	Do. 3rd Class.	
520	*Muhammad Zafr-ud-din*	Do. do.	
521	*J. Guruswami Nayudu*	Do. 1st Class.	
522	*M. Kuppuswami Achari*	Do. · do.	
523	*C. M. Lakshmana Pillai*	Do. do.	
	1883.		
524	George Ellis	Draftsman and Estimator, 1st Class .	Prize.
525	M. Embrayya Nayudu	Do. do.	
526	K. S. Satakopa Mudali	Do. 2nd Class.	
527	P. Sundararamanjulu Nayudu ..	Do. do.	
528	T. Kandaswami Pillai	Do. 3rd Class.	
529	P. Narayanaswami Nayakar ..	Do. do.	
530	T. Viraswami Nayudu	Do. do.	
531	C. Viraraghava Pillai	Do. · do.	

No.	Name.	Certificate.	Remarks.
532	*E. Ratna Mudaliyar*	Draftsman and Estimator, 1st Class.	
533	*C. Rajagopala Nayudu*	Do. 2nd Class.	
534	*P. Murugesa Mudali*	Do. 1st Class.	
535	*C. Kuppuswami Nayudu*	Do. 3rd Class.	
536	*A. Ram Sing Takar*	Do. 2nd Class.	
537	*R. Venkaturau Pantulu*	Do. do.	
538	*R. F. Fletcher*	Do. 1st Class.	
539	*D. John Pillai*	Do. do.	
540	*Bhavani Sing*	Do. do.	
541	*J. Lakshminarayanayya*	Do. 3rd Class.	
542	*B. Kotayya*	Do. do.	
543	*C. Ratnam*	Do. 1st Class.	
544	*P. V. Raghavayya*	Do. 2nd Class.	
545	*V. V. Subharayar*	Do. 3rd Class.	
	1884.		
546	T. Kandaswami Pillai	Draftsman and Estimator, 2nd Class.	
547	L. Narasimhulu Nayudu	Do. do.	Prize.
548	M. A. Muttu Pillai	Do. do.	
549	K. S. Aravamuthu Aiyangar	Do. 3rd Class.	
550	C. Nagalinga Mudaliar	Do. do.	
551	C. Muttukuppuratna Mudaliyar	Do. do.	
552	E. Satakopa Pillai	Do. do.	
553	Muhammad Majid Khan	Do. do.	
554	*B. Kotayya*	Do. 2nd Class.	
555	*P. V. Raghavayya Nayudu*	Do. 1st Class.	
556	*R. Narasimha Rau Nayudu*	Do. do.	
557	*V. Parthasarathi Mudaliyar*	Do. 2nd Class.	
558	*N. Rangayya Nayudu*	Do. do.	
559	*Saiyid Mahmud*	Do. do.	
560	*R. Venkataswami*	Do. do.	
561	*P. Sabhapati Mudaliyar*	Do. 3rd Class.	
562	*M. Mannaru Raju*	Do. do.	
563	*T. Kosalaram Pillai*	Do. do.	
564	*P. C. Krishnaswami Aiyangar*	Do. do.	
565	*V. Srinivasulu Nayudu*	Do. do.	
566	*T. A. Susia Pillai*	Do. do.	
567	*V. Venkatanarasimha Charlu*	Do. do.	
568	*M. Butchayya*	Do. do.	
569	*P. Venkanna*	Do. do.	
570	*P. Viraraghavayua*	Do. do.	
571	*D. Subharayudu*	Do. do.	
572	*A. Lakshminarayana*	Do. 2nd Class.	
573	*P. Balaramayya Nayudu*	Do. do.	
574	*Naraharisetti Sastrulu*	Do. 3rd Class.	

No.	Name.	Certificate.	Remarks.
	1885.		
575	A. Periaswami Pillai	Draftsman and Estimator, 2nd Class.	
576	A. M. Appana Aiyangar	Do. 3rd Class	Prize.
577	A. Raghavendra Mudaliyar	Do. do.	
578	T. Ponnuswami Mudaliyar	Do. do.	
579	P. M. Parthasarathi Pillai	Do. do.	
580	N. B. Rangaswami Aiyangar	Do. do.	
581	S. Madalamuttu Pillai	Do. do.	
582	*T. A. Susia Pillai*	Do. 2nd Class.	
583	*V. Ettiraja Mudaliyar*	Do. do.	
584	*V. A. Muttukrishna Pillai*	Do. 3rd Class.	
585	*P. Ramaswami Nayudu*	Do. do.	
586	*G. Raghunatha Rau*	Do. do.	
587	*T. S. Govindaswami Pillai*	Do. 2nd Class.	
588	*C. Sesha Chari*	Do. 1st Class.	
589	*L. F. A. Ambrose*	Do. 3rd Class.	
590	*V. Rudraswami Nayudu*	Do. 1st Class.	
591	*T. Subrahmanya Pillai*	Do. do.	
592	*T. Viraswami Nayudu*	Do. 3rd Class.	
593	*T. Muttuswami Pillai*	Do. 1st Class.	
594	*R. N. Parasurama Mudaliyar*	Do. 3rd Class.	
595	*D. Viraswami Nayudu*	Do. 2nd Class.	
596	*S. Ranganayakulu*	Do 3rd Class.	
597	*T. V. Subharau Nayudu*	Do. do.	
598	*T. Rangaswami Pillai*	Do. do.	
599	*R. S. Lakshminarasimham*	Do. do.	
600	*C. Raghava Charlu*	Do. 2nd Class.	
601	*K. Kotilingam*	Do. 3rd Class.	
602	*P. Viraswami Nayudu*	Do. 1st Class.	
603	*P. Venkanna*	Do. 2nd Class.	
604	*P. Jaggaraju*	Do. do.	
605	*D. Lakshminarayana*	Do. 3rd Class.	
606	*B. Lingappa Sastri*	Do. do.	
607	*P. V. Raghavayya Nayudu*	Do. 2nd Class.	
608	*K. Appalanarasayya*	Do. 3rd Class.	
609	*V. Narayana Rau*	Do. do.	
	1886.		
610	A. Tambu Chetti	Draftsman and Estimator, 1st Class	Prize.
611	E. A. Sivakrishnaswami Aiyar	Do. do.	
612	M. Angamuttu Mudaliyar	Do. do.	
613	A. V. Ramachandra Aiyar	Do. do.	
614	T. M. Swarnam Pillai	Do. 2nd Class.	
615	T. Raghunatha Rau	Do. do.	
616	S. W. Damodara Pillai	Do. do.	

Draftsmen.

No.	Name.	Certificate.	Remarks.
617	V. Natesa Aiyar	Draftsman and Estimator, 2nd Class.	
618	M. Srinivasa Nayakar	Do. do.	
619	N. K. Muttuswami Aiyar	Do. 3rd Class.	
620	C. Duraiswami Nayudu	Do. do.	
621	A. Subrahmanya Aiyar	Do. do.	
622	A. Krishna Rau	Do. do.	
623	M. G. Krishnama Chari	Do. do.	
624	C. Sivasankara Mudaliyar	Do. do.	
625	R. Chenchayya Nayudu	Do. do.	
626	A. Krishnaswami Aiyar	Do. do.	
627	P. Subhu Venkatachalam	Do. do.	
628	*Saiyid Mahmud Sahib*	Do. 1st Class.	
629	*R. A. Muttuswami Achari*	Do. do.	
630	*M. Rangaswami Pillai*	Do. do.	
631	*R. Sivasubrahmanya Aiyar*	Do. do.	
632	*A. Raghavendra Mudaliyar*	Do. do.	
633	*C. Viraswami Achari*	Do. do.	
634	*T. Ponnuswami Mudaliyar*	Do. do.	
635	*N. B. Rangaswami Aiyangar*	Do. do.	
636	*V. R. Shanmukham*	Do. do.	
637	*C. Rajagopala Nayudu*	Do. do.	
638	*A. Ettiraja Mudaliyar*	Do. do.	
639	*P. M. Parthasarathi Pillai*	Do. 2nd Class.	
640	*M. Rajaratna Nayakar*	Do. do.	
641	*C. Ekambara Mudaliyar*	Do. do.	
642	*C. Parthasarathi Mudaliyar*	Do. do.	
643	*M. Ramaswami Raju*	Do. do.	
644	*Y. Vallabharayudu Nayudu*	Do. do.	
645	*P. C. Krishnaswami Aiyangar*	Do. do.	
646	*S. Ganesa Aiyar*	Do. do.	
647	*R. N. Parasurama Mudaliyar*	Do. do.	
648	*B. N. Muttu Alagiri Nayudu*	Do. 3rd Class.	
649	*C. Narayana Raju*	Do. do.	
650	*M. R. Seshagiri Aiyar*	Do. do.	
651	*A. Venugopala Nayudu*	Do. do.	
652	*M. Adimula Mudaliyar*	Do. do.	
53	*C. L. Ramaswami Mudaliyar*	Do. do.	
54	*P. K. Desikachariar*	Do. do.	
55	*C. H. Sabhaji Rau*	Do. do.	
56	*S. Ramaswami Nayudu*	Do. do.	
57	*M. Manikka Pillai*	Do. do.	
58	*R. N. Tiruvenkataswami*	Do. do.	
59	*N. Srinivasa Rau*	Do. do.	
60	*T. Gopala Nayudu*	Do. do.	
61	*C. Sarangapani Pillai*	Do. do.	
62	*M. T. Sivasankara Mudaliyar*	Do. do.	
63	*R. S. Lakshminarasimham*	Do. 1st Class.	
64	*A. Lakshminarayana*	Do. do.	
65	*P. Narayanarau Nayudu*	Do. 3rd Class.	
66	*C. Varadaraja Mudaliyar*	Do. 2nd Class.	

No.	Name.	Certificate.	Remarks.
667	*A. Paukianathan Pillai*	Draftsman and Estimator, 1st Class.	
668	*B. Lingappa Sastri*	Do. 2nd Class.	
669	*R. Viraraghavaya Nayudu*	Do. 1st Class.	
670	*K. Gopalan*	Do. 3rd Class.	
671	*P. Venkataraju*	Do. do.	
672	*Lanka Ramaswami*	Do. do.	
673	*D. Subharayudu*	Do. 2nd Class.	
674	*M. Brahmaji Rau*	Do. do.	
675	*N. Ramayya*	Do. 3rd Class.	
676	*N. Virabhadrayya*	Do. do.	
677	*K. Narayanaswami*	Do. do.	
	May 1887.		
678	M. S. Sankaranarayana Pillai	Draftsman and Estimator, 2nd Class.	Prize.
679	John D. Francis	Do. 3rd Class.	
680	R. Srinivasa Aiyar	Do. do.	
681	John Charles Adolphus Ellis	Do. do.	
682	Ramaswami Nayakar	Do. do.	
683	T. Krishnaswami Pillai	Do. do.	
684	R. Kodandarama Mudaliyar	Do. do.	
685	P. Darmarajulu Nayudu	Do. 2nd Class.	
686	T. Seshachala Rau	Do. do.	
687	N. Srinivasa Aiyangar	Do. do.	
688	M. Govindaraja Mudaliyar	Do. do.	
689	A. Somanatha Aiyar	Do. do.	
690	John Conrad Jacobi	Do. do.	
691	T. P. Duraswami Pillai	Do. do.	
692	N. Rangaswami Nayudu	Do. do.	
693	Gunr. J. S. Freemantle, Rl. Art.	Do. do.	Passed from the Engineer Subordinate Class.
694	*G. M. Guruswami Nayudu*	Do. 3rd Class.	
695	*A. Ratnasabhapati Mudaliyar*	Do. do.	
696	*M. Venkata Rau*	Do. do.	
697	*V. Ramabrahmam*	Do. do.	
698	*T. P. Narayanaswami Pillai*	Do. do.	
699	*T. Chinnappa Mudaliyar*	Do. do.	
700	*L. D' Cruz*	Do. do.	
	Dec. 1887.		
701	W. C. H. Littlewood	Draftsman, 1st Class	Silver medal.
	1888.		
702	H. Narayanayya	Draftsman, 2nd Class	Silver medal. Prize for Geom., &c., and Machine Drawg.

Draftsmen.

No.	Name.	Certificate.	Remarks.
703	A. S. Visvanatha Aiyar	Draftsman, 2nd Class ..	Silver medal. Prize for Building and Topo. Drawg., and Estimg.
704	K. A. Subrahmanya Sarma ..	Do. 3rd Class.	
705	T. A. Sandanam Pillai	Do. do.	
706	T. Narasinga Rau	Do. do.	
	1889.		
707	A. K. Setu Rau	Draftsman, 3rd Class ..	Bronze medal. Prize for Building and Machine Drawg., and Estimg.
708	T. A. Muttukrishna Nayudu ..	Do. 2nd Class.	
709	P. Jagannayakulu Nayudu ..	Do. 3rd Class.	
710	C. Muttukrishna Mudaliyar ..	Do. do.	
711	T. Tiruvenkada Pillai	Do. do.	
712	*R. S. Venugopala Nayudu.. ..*	Do. 2nd Class.	
713	*A. Vajjiravelu Mudaliyar .. ..*	Do. 3rd Class.	
714	*P. Amirtalinga Mudaliyar.. ..*	Do. do.	
715	*K. Perayya Nayudu .. ..*	Do do	
716	*V. Nagalinga Achari .. ..*	Do. do.	
	1890.		
717	S. Subrahmanya Aiyar	Draftsman, 2nd Class ..	Bronze medal. Prize for Building, Machine, & Freehand, Model and Perspective Drawg.
718	M. V. Srinivasa Aiyar	Do. 1st Class ..	Prize for Estimg.
719	D. Tiruvenkada Mudaliyar ..	Do. 2nd Class.	
720	S A. Manikkaswami Mudaliyar..	Do. do	
721	F. W. Cames	Do. 3rd Class.	
722	L. A. Natesa Aiyar	Do. do.	
723	*V. Damodara Mudaliyar .. ..*	Do. do.	
724	*T. A Mariudas Achari .. ..*	Do. do.	
725	*T. K. Gopala Chari .. ..*	Do. do.	
726	*G. Vaidyanatha Aiyar .. ..*	Do. do.	
727	*P. Subharayulu Nayudu .. ..*	Do. do.	
	1891.		
728	P. S. Tiruchelvam Pillai ..	Draftsman, 1st Class ..	Bronze medal. Prize for Estimg. and Machine Drawg.
729	M. Kanakasabhai Mudaliyar ..	Do. do. ..	Prize for Building Drawg.
730	N. Appayya Rau	Do. do.	
731	S. Venkatachalam	Do. 2nd Class.	

No.	Name.	Certificate.	Remarks.
732	S. J. Swamikannu Mudaliyar ..	Draftsman, 2nd Class.	
733	R. Abel	Do. do.	
734	P. Subharayudu Nayudu ..	Do. do.	
[illegible]	B. R. Ramakrishna Aiyangar ..	Do. 3rd Class.	
[illegible]	A. V. Natesa Aiyar	Do. do.	
737	V. Venkatarama Aiyar	Do. do.	
738	*S. Subrahmanya Aiyar*	Do. 1st Class.	
739	*A. K. Setu Rau*	Do. do.	
	1892.		
740	S. Rama Aiyar	Draftsman, 2nd Class ..	Bronze medal. Prize for Drawg.
741	S. Rangaswami Nayudu	Do. do. ..	Prize for Drawing.
742	T. C. Ananta Aiyar . ..	Do. do.	
743	M. S. Tambuswami Pillai .	Do. do.	
744	G. Malleswara Prasada Rau ..	Do. 3rd Class.	
745	S. V. Krishnaswami Aiyangar .	Do. do.	
746	A. L. Singaravelu Mudaliar ..	Do. do.	
747	S. Purandara Rau	Do. do.	
748	D. Srinivasa Aiyangar	Do. do.	
749	V. Aravamuthachari	Do. do.	
750	R. Krishna Rau	Do. do.	
751	P. S. Jambulinga Mudaliyar ..	Do. do.	
752	S. Subbarama Aiyar	Do. do.	
753	P. Krishnaswami Mudaliyar ..	Do. do.	
754	A. Srinivasa Rau	Do. do.	
755	C. N. Rama Rau	Do. do.	
756	A. Ratnavelu Mudaliyar ..	Do. do.	
757	T. Ponnaranga Pillai	Do. do.	
758	*R. Bujanga Rau*	Do. do.	
	1893.		
759	N. L. Ramachandra Rau ..	Draftsman, 2nd Class ..	Bronze medal. Prize for General Proficiency.
760	D. N. Narasimhayya	Do. do. ..	Prize for do.
761	T. R. Krishnaswami Aiyar ..	Do. do.	
762	Y. Rajabathar Mudaliyar ..	Do. do.	
763	T. Krishna Rau	Do. do.	
764	V. Venkatarama Aiyangar ..	Do. 3rd Class ..	Prize for Estimating.
765	A. Mariasusai Pillai	Do. do.	
766	S. Subbarama Aiyar	Do. do.	
767	C. Virabrahmam	Do. do.	
768	C. S. Kuppu Rau	Do. do.	
769	R. Chithambara Mudaliyar ..	Do. do.	
770	G. Kesavalu Nayudu	Do. do.	
771	G. Kamaraju	Do. do.	

Draftsmen.

No.	Name.	Certificate.	Remarks.
772	K. Krishnamachari	Draftsman, 3rd Class.	Prize for Estimating.
773	K. Lakshmikanta Rau	Do. do.	
774	M. Subbarau Nayudu	Do. do.	
775	T. M. Sankara Rau	Do. do.	
776	V. riSnivasa Aiyar	Do. do.	
777	A. D. Nallaswami Nayudu	Do. do.	
778	G. Kasturi Chetti	Do. do.	
779	C. Ratnasabhapati Mudaliyar	Do. do.	
780	*A. L. Singaravelu Mudaliyar*	Do. 2nd Class.	
781	*S. Purandara Rau*	Do. do.	
782	*W. Chinnaswami Nayudu*	Do. 3rd Class.	
783	*V. Subrahmanya Aiyar*	Do. do.	
	1894.		
784	A. Kuppuswami Aiyangar	Draftsman, 3rd Class	Bronze medal.
785	A. V. Rajabathar Mudaliyar	Do. do.	Prize for Estimating.
786	K. Chinnaswami Nayudu	Do. do.	
787	S. Subrahmanya Aiyar	Do. do.	
788	S. K. Srinivasa Aiyangar	Do. do.	
789	H. I. Gnanaveram	Do. do.	
790	T. V. Venugopala Chetti	Do. do.	
791	P. V. Hanumanta Rau	Do. do.	
792	T. P. Lakshmana Aiyar	Do. do.	
793	A. Ponnuthorai Pillai	Do. do.	
794	D. V. Krishnayya	Do. do.	
795	M. Singaravelu Chetti	Do. do.	
796	C. K. Krishna Rau	Do. do.	
797	D. Kotayya	Do. do.	
798	T. Parankusam Nayudu	Do. do.	
799	*N. L. Ramachandra Rau*	Do. 1st Class.	
800	*T. Ranganatha Mudaliyar*	Do. 3rd Class.	
801	*G. V. Balakrishna Chetty*	Do. do.	
802	*N. Raghunatha Rau*	Do. do.	
	1895.		
803	S. Sandanam Pillai	Draftsman, 1st Class	Bronze medal. Prize for Drawing.
804	S. Gaurisankara Sarma	Do. do.	Prize for Drawing.
805	T. Krishnaswami Mudaliyar	Do. do.	
806	V. M. Duraiswami Mudaliyar	Do. 2nd Class	Prize for Drawing.
807	A. J. Arulraya Pillai	Do. do.	
808	N. Anantarama Pillai	Do. do.	
809	V. C. Krishnaswami Mudaliyar	Do. 3rd Class.	
810	A. Varadaraja Aiyar	Do. do.	
811	K. Venkataranga Rau	Do. do.	
812	C. P. Susayanatha Mudaliyar	Do. do.	
813	D. Suriyanarayana	Do. do.	
814	G. Sriramulu	Do. do.	
815	S. J. Abraham Mudali	Do. do.	

No.	Name.	Certificate.	Remarks.
816	C. Duraiswami Reddi	Draftsman, 3rd Class.	
817	S. Narasimhayya	Do. do.	
818	K. Ramaswami Aiyar	Do. do.	
819	S. Lakshminarayana	Do. do.	
820	W. Kannuswami Mudaliyar ..	Do. do.	
[illegible]21	S. Sriramulu Nayudu	Do. do.	
822	W. Rajagopala Mudaliyar ..	Do. do.	
823	*A. V. Rajabathar Mudaliyar* ..	Do. 1st Class.	
824	*T. Narayana Aiyangar*	Do. 2nd Class.	
825	*A. Parvatisam*	Do. do.	
826	*R. Chidambara Mudaliyar*	Do. do.	
827	*A. Vodiyaperumal Nayudu* ..	Do. 3rd Class.	
828	*V. K. Ramaswami Pillai*	Do. do.	
829	*S. Srinivasa Chari*	Do. do.	
830	*A. Sundara Varatha Chari* ..	Do. do.	
831	*D. D. Winfred*	Do. do.	

LIST of Persons who have been awarded Certificates of qualification as SURVEYORS on the results of Examinations held in connection with the College of Engineering, Madras.

(Note.—Names shown in italics are those of independent candidates; all others are those of College students.)

No.	Name.	Certificate.	Remarks.
	1862.		
1	J. Hooper	Surveyor.	
2	V. Jagannayakulu Nayudu	Surveyor, 2nd Class.	
3	J. D'Silva	Do. do.	
4	T. L. Febour	Do. do.	
5	E. Carr	Do. do.	
	1863.		
6	Copl. F. Washington, Saps. and Mins.	Surveyor, 1st Class	Passed from th 2nd Department.
7	Copl. William Davis, Saps. & Mins.	Do. do.	
8	G. McIntyre	Do. do.	
9	W. T. P. Moore	Do. do.	
10	A. Wylie	Do. 2nd Class.	
11	A. Arogyaswami Pillai	Do. 1st Class.	
12	T. Rajagopala Mudaliyar	Do. do.	
13	J. Padmanabha Nayudu	Do. do.	
14	W. Hussey	Do. 2nd Class.	
15	C. Murugesa Mudaliyar	Do. do.	
16	John Jackson	Do. do.	
17	*V. Ananta Chari*	Do. do.	
	1864.		
18	G. R. Fisher	Surveyor, 2nd Class.	
19	J. D. McLeod	Do. 1st Class.	
20	S. Rama Rau	Do. do.	
21	J. E. Bonjour	Do. do.	
22	T. Krishnaswami Nayudu	Do. 3rd Class.	
23	G. Vijayaraghavulu Nayudu	Do. 2nd Class.	
24	V. Teroo Ramayya	Do. 1st Class.	
25	C. Kuppuswami Mudaliyar	Do. do.	
26	A. G. King	Do. 2nd Class.	
27	F. W. Fitzpatrick	Do. do.	
28	C. Kesavulu	Do. 3rd Class.	
29	C. Narayanayya	Do. do.	
30	T. Venkatakrishnan	Do. do.	
31	C. Ratnamuttu Pillai	Do. 1st Class.	
32	P. C. Vijayaraghava Chari	Do. 2nd Class.	

Surveyors.

No.	Name.	Certificate.	Remarks.
	1865.		
33	P. S. Arunachala Mudaliyar ..	Surveyor, 2nd Class.	
34	V. S. Ramanuja Chariar ..	Do. do.	
35	B. Narasimhulu Nayudu ..	Do. do.	
36	P. Singaravelu Mudaliyar ..	Do. 1st Class.	
37	M. Munuswami Nayudu ..	Do. 3rd Class.	
38	A. G. King	Do. 1st Class.	
39	F. W. Fitzpatrick	Do. do.	
40	Thomas Kelly	Do. 2nd Class.	
41	H. M. Bond	Do. do.	
42	P. Narasimha Chari	Do. do.	
43	P. Arunachala Mudaliyar ..	Do. 3rd Class.	
44	C. E. Court	Do. do.	
45	W. Craggs	Do. do.	
	1866.		
46	C. Ponnuswami Mudaliyar ..	Surveyor, 2nd Class.	
47	C. Fitzgerald	Do. 1st Class.	
48	V. A. Viraswami	Do. do.	
49	A. King	Do. do.	
50	C. Adinarayanaswami	Do. 2nd Class.	
51	M. Srikrishnulu	Do. do..	
52	J. C. Hudson	Do. do.	
53	M. Jagannatham	Do. do.	
54	S. Ramanjayya	Do. do.	
55	T. Parthasarathi Nayudu ..	Do. 3rd Class.	
56	C. Venugopala Mudaliyar ..	Do. do.	
57	*S. Ramanjayya*	Do. 2nd Class.	
58	*D. Sinclair*	Do. 1st Class (Rev. Surv.).	
	1867.		
59	*R. Pelly*	Surveyor, (Rev. Surv.).	
60	*C. Narayanayya*	Do. 2nd Class (Rev. Surv.).	
61	*P. Murugesa Mudaliyar*	Do. do.	
62	*M. Ponnuswami Mudaliyar* ..	Do. do.	
63	E. Foord	Do. 1st Class.	
64	E. Dady	Do. do.	
65	McGrath	Do. do.	
66	J. G. Barnett	Do. 2nd Class.	
67	G. Gamble	Do. do.	
68	S. W. Dixon	Do. do.	
69	E. Meneand	Do. do.	
70	L. Manikkam	Do. do.	
71	W. Harris	Do. do.	
72	C. Venugopala Mudali	Do. do.	

No.	Name.	Certificate.	Remarks.
73	*J. A. Ross*	Surveyor, 2nd Class.	
74	*C. Venkatachala Mudaliyar*	Do. do.	
75	*M. Rangayya Nayudu*	Do. do.	
76	*S. Ratna Mudaliyar*	Do. 3rd Class.	
	1868.		
77	*E. R. Joseph*	Surveyor, 1st Class (Rev. Surv.).	
78	*T. Perreire*	Do. do.	
79	*Lieut. C. C. Sergeaunt, S. C.*	Do. (Rev. Surv.).	
80	*C. Narayanayya*	Do. 1st Class (Rev. Surv.).	
81	A. McGrath	Do. 2nd Class	**1st Prize.**
82	J. C. Walker	Do. do.	**2nd Prize.**
83	V. Vardarajulu Mudali	Do. do.	
84	H. Van Deerlin	Do. do.	
85	*G. Trewman*	Do. do.	
86	*D. W. Gibson*	Do. do.	
87	*T. A. Marimuttu Achari*	Do. do.	
88	*Sergt. H. Perrin, Saps. & Mins.*	Do. 1st Class.	
89	*E. Baber*	Do. (Rev. Survey).	
90	*J. H. Cook*	Do. do.	
91	*C. Arumukham*	Do. 3rd Class.	
92	*P. B. Pathum Lal*	Do. do.	
93	*M. Chinnayya Pillai*	Do. do.	
94	*V. Manikkam*	Do. do.	
95	*R. Cochrane*	Do. do.	
96	*C. Balasundara Mudaliyar*	Do. do.	
97	*Abdullah Khan*	Do. do.	
	1869.		
98	*S. T. M. Rangayya Nayudu*	Surveyor, 2nd Class.	
99	*Captain C. A. Liardet, S. C.*	Do. (Rev. Surv.).	
100	*J. H. Merriman*	Do. do.	
101	*F. T. Bagshawe*	Do. do.	
102	E. M. Walter	Do. 1st Class.	
103	M. Chinnayya Pillai	Do. do.	
104	H. O'Sullivan	Do. 2nd Class.	
105	J. Kelly	Do. do.	
106	H. M. Upshon	Do. do.	
107	H. Bowers	Do. do.	
108	A. Munuswami	Do. 3rd Class.	
109	T. S. Bhagyanatha Pillai	Do. do.	
110	E. J. Rieley	Do. 2nd Class.	
111	*B. Johnson*	Do. 3rd Class.	
112	*S. Kenrick*	Do. 1st Class.	

Surveyors.

No.	Name.	Certificate.	Remarks.
113	*T. Krishnaswami Nayudu*	Surveyor, 2nd Class.	
114	*C. Varadarajulu Mudali*	Do. do.	
115	*K. Kandaswami Mudali*	Do. do.	
116	*J. Buchanan*	Do. 3rd Class.	
117	*S. Jagannathaswami Pillai* ..	Do. do.	
118	*William King*	Do. (Rev. Survey).	
119	*G. D. Godfrey*	Do. 2nd Class.	
120	*S. T. Devarajulu Nayudu*	Do. do.	
121	*A. Sivaramayya*	Do. do.	
122	*S. Gurumurti Chetti*	Do. do.	
123	*H. Lecot*	Do. do.	
	1870.		
124	*A. M. Atkinson*	Surveyor, 2nd Class.	
125	*T. Chinnaswami Mudaliyar* ..	Do. 3rd Class.	
126	*A. Jagannatha Mudaliyar*	Do. 2nd Class.	
127	*C. Jagannatha Mudaliyar*	Do. 3rd Class.	
128	J. B. Cranfield	Do. 1st Class. ..	1st Prize.
129	R. McMorran	Do. do. ..	2nd Prize.
130	H. O'Neil	Do. 2nd Class.	
131	R. F. Thomas	Do. do.	
132	J. Hayes	Do. do.	
133	T. L. Oliver	Do. 3rd Class.	
134	J. Baptist	Do. do.	
135	J. Dixon	Do. do.	
136	P. Lynch	Do. do.	
137	A. Martin	Do. do.	
138	*J. O. Butler*	Do. (Rev. Survey).	
139	*C. Murugesa Nayak*	Do. 3rd Class.	
140	*J. Buchanan*	Do. 2nd Class.	
141	*A. Namasivaya Mudaliyar* ..	Do. 3rd Class.	
142	*Shafi Khan*	Do. do	
	1871.		
143	*W. E. Satur*	Surveyor, 3rd Class.	
144	*Abdul Kuddis*	Do. do.	
145	R. F. Thomas	Do. 1st Class ..	1st Prize.
146	Muhammad Azim-ud-din ..	Do. do. ..	2nd Prize.
147	Abdul Latif	Do. do.	
148	C. Subrahmanyam	Do. 2nd Class.	
149	M. E. D'Lemos	Do. 3rd Class.	
150	D. Muller	Do. do.	
151	C. Donovan	Do. do.	
152	J. Seaman	Do. do.	
153	*M. C. Borgen*	Do. do.	
	1872.		
154	*C. Ramaswami Rau*	Surveyor, 1st Class.	
155	*D. C. Donovan*	Do. 3rd Class	

No.	Name.	Certificate.	Remarks.
156	*P. Shanmukha Mudali*	Surveyor, 3rd Class.	
157	*A. McGrath*	Do. 1st Class.	
158	P. Whitbread	Do. 2nd Class. ..	1st Prize.
159	A. Burby	Do. do. ..	2nd Prize.
160	S. Vijayaraghavulu Nayudu ..	Do. 3rd Class.	
161	S. Ritherford	Do. do.	
162	J. Muller	Do. do.	
163	H. T. Taylor	Do. do.	
164	E. A. Barren	Do. do.	
165	F. W. Tyrrel	Do. do.	
166	A. M. Lazarus	Do. do.	
167	J. R. J. Urilla	Do. do.	
168	H. Wright	Do. do.	
169	J. M. Ring	Do. do.	
170	J. H. D'Vaz	Do. do.	
171	*C. V. Chinnayya Mudali*	Do. do.	
172	*Zahid Khan Sahib*	Do. do.	
173	*T. Perumal Nayudu*	Do. 2nd Class.	
	1873.		
174	*V. Nagalinga Mudaliyar*	Surveyor, 3rd Class.	
175	*J. McNamara*	Do. do.	
176	H. Montgomery	Do. do. ..	1st Prize.
177	T. S. Beale	Do. do.	
178	Ghulam Qadir Sahib	Do. do.	
179	C. Venkatesa Aiyar	Do. do. ..	2nd Prize.
180	Muhammad Naki	Do. do.	
181	*F. Hines*	Do. do.	
182	*T. R. Cooper*	Do. 2nd Class.	
183	*J. Pereira*	Do. do.	
184	*M. Ratna Pillai*	Do. 3rd Class.	
185	*J. Bond*	Do. do.	
186	*W. Faraday*	Do. do.	
187	*W. Murrel*	Do. do.	
	1874.		
188	*C. R. Kodandarama Aiyar* ..	Surveyor, 3rd Class.	
189	*R. Venkata Rau*	Do. do.	
190	C. Lawrence	Do. 1st Class.	
191	M. Ponnuswami	Do. do.	
192	W. E. Johannes	Do. 2nd Class.	
193	A. Arbhutha Mudali	Do. do.	
194	J. Crawley	Do. do.	
195	G. Piellow	Do. 3rd Class.	
196	M. Ramaswami Nayudu	Do. do.	
197	A. Johnson	Do. do.	
198	A. Ponnuswami	Do. do.	

Surveyors.

No.	Name.	Certificate.	Remarks.
199	H. L. Wheeler	Surveyor, 3rd Class.	
200	C. A. L. Pereira	Do. do.	
201	P. Purushottam	Do. do.	
202	S. Bhashyakarlu Aiyar	Do. do.	
	1875.		
203	V. Bhashya Mudaliyar	Surveyor, 2nd Class.	
204	J. H. Macleod	Do. do.	
205	R. W. Sturgess	Do. do.	
206	C. H. Marrow	Do. 3rd Class.	
207	M. Tiruvenkata Mudaliyar	Do. do.	
208	Shaikh Tipu	Do. do.	
209	Vedamanikkam	Do do.	
210	T. Gnanaprakasa Pillai	Do. 2nd Class.	
211	E. Fitzgerald	Do. do.	
212	J. S. Davey	Do. do.	
213	J. Turnbull	Do. do.	
214	*A. Tiruvenkataswami Mudaliyar*	Do. 3rd Class.	
	1876.		
215	*P. A. Ponnaranga Mudali*	Surveyor, 3rd Class.	
216	*Gunr. Maurice Digby, Rl. Art.*	Do. do.	
217	K. Swaminatha Aiyar	Do. 2nd Class	1st Prize.
218	A. J. Gulamier	Do. do.	2nd Prize.
219	M. Velavendraswami Pillai	Do. 3rd Class.	
220	M. Alwar Nayudu	Do. do.	
221	A. P. Yellowsaw	Do. do.	
222	A. Srinivasulu Nayudu	Do. do.	
223	A. Tambidurai Mudali	Do. do.	
224	A. Vedaji Rau	Do. do.	
225	M. Kandaswami Mudali	Do. do.	
226	A Aravamudu Nayudu	Do. do.	
227	M. Abdur Rahman	Do. do.	
228	M. Chinnaswami Nayudu	Do. do.	
229	D. Shams-ud-din	Do. do.	
	1877.		
230	*M. V. Sambasiva Aiyar*	Surveyor, 3rd Class.	
231	R. A. Muttuswami Achari	Do. 1st Class	1st Prize.
232	P. R. Venkataswami Nayudu	Do. 2nd Class	2nd Prize.
233	A. Susia Pillai	Do. 3rd Class.	
234	G. A. Grogan	Do. do.	
235	I. Angelo	Do. do.	
236	T. G. Ratnam	Do. do.	
237	N. Gnanaprakasam	Do. do.	

No.	Name.	Certificate.	Remarks.
238	M. Tambayya	Surveyor, 3rd Class.	
239	V. Sabhapati Mudaliyar	Do. do.	
240	R. Srinivasa Rau	Do. do.	
241	W. E. Grayson	Do. do.	
242	V. Ramalinga Mudali	Do. do.	
243	C. Venkatachalayya	Do. do.	
244	T. B. Kasi Rau	Do. do.	
245	S. Laffrey	Do. do.	

1878.

No.	Name.	Certificate.	Remarks.
246	R. Kenneth Ashe	Surveyor, 2nd Class	**1st Prize.**
247	T. Madhava Rau	Do. do.	**2nd Prize.**
248	S. Aravamudu Aiyangar	Do. do.	
249	T. Sambhu Rau	Do. 3rd Class.	
250	P. Pushpanatha Pillai	Do. do.	
251	C. S. Vaidynatha Aiyar	Do. do.	
252	S. P. Bhagyanatha Pillai	Do. do.	
253	*A. I. Daniel*	Do. do.	
254	*S. Daivasikhamani Mudaliyar*	Do. do.	

1879.

No.	Name.	Certificate.	Remarks.
255	W. C. Rebeiro	Surveyor, 2nd Class	**1st Prize.**
256	C. Vijayaranga Pillai	Do. do.	**2nd Prize.**
257	S. Manikka Mudali	Do. do.	
258	P. S. Chokkalinga Mudali	Do. do.	
259	C. Parthasarathi Mudali	Do. 3rd Class.	
260	M. Namasivaya Pillai	Do. do.	
261	C. Manikka Mudali	Do. do.	
262	H. L. Egna Lal	Do. do.	
263	A. P. Velayuda Pillai	Do. do.	
264	M. Chinnayya Nayudu	Do. do.	
265	V. Chokkalinga Pillai	Do. do.	
266	C. Ettirajulu Nayudu	Do. do.	
267	M. A. Venkatarama Aiyar	Do. do.	
268	R. Venugopala Pillai	Do. do.	
269	*P. Subrahmanya Aiyar*	Do. 1st Class.	

1880.

No.	Name.	Certificate.	Remarks.
270	K. R. Krishnaswami Aiyar	Surveyor, 3rd Class	**Prize.**
271	S. Seshayya Raju	Do. do.	
272	K. S. Sundaranatha Pillai	Do. do.	
273	O. Ramakrishna Nayudu	Do. do.	
274	J. C. Chelvanayaga Pillai	Do. do.	
275	K. Ratnaswami Mudali	Do. do.	
276	A. Pushpanatha Pillai	Do. do.	
277	T. M. Sadasiva Pillai	Do. do.	
278	*S. Charles Moss*	Do. do.	

No.	Name.	Certificate.	Remarks.
	1881.		
279	C. Devaraja Pillai	Surveyor, 2nd Class.	
280	A. Vadivelu Mudali	Do. 3rd Class.	
281	V. Parthasarathi Mudali	Do. do.	Prize.
282	P. Sundaranatha Pillai	Do. do.	
283	V. Ramaswami Jagamurti	Do. do.	
284	S. Singaravelu Mudali	Do. do.	
285	C. Muttukuppuratna Mudali	Do. do.	
286	E. G. Rosemeyer	Do. do.	
	1882.		
287	K. A. Krishnama Chari	Surveyor, 2nd Class.	
288	P. S. Ananthanatha Pillai	Do. do.	
289	V. Daivasikhamani Pillai	Do. do.	
290	A. Ramaswami Mudaliyar	Do. do.	
291	Thomas Noronho	Do. 3rd Class.	
292	T. T. Anthonimuttu Pillai	Do. do.	
293	*S. Ramachandra Aiyar*	Do. do.	
	1883.		
294	R. Sivasubramanya Aiyar	Surveyor, 1st Class	Prize.
295	M. A. Muttu Pillai	Do. 3rd Class.	
	1884.		
296	A. Periaswami Pillai	Surveyor, 2nd Class	Prize.
297	K. Srinivasulu Mudaliyar	Do. 3rd Class	
298	S. L. Hari Rau	Do. do.	
299	R. Arogyaswami Mudali	Do. do.	
	1885.		
300	George Robert Clarkson	Surveyor, 2nd Class	Prize.
301	T. A. Gnanaprakasa Pillai	Do. do.	
302	I. Venkataratna Nayudu	Do. 3rd Class.	
303	Frederick Horst Burr	Do. do.	
304	P. J. de Lang	Do. do.	
305	M. F. D'Rozario	Do. do.	
306	K. S. Satakopa Mudaliyar	Do. do.	
307	*William Henry Jackson*	Do. do.	
308	*N. M. Wright Ringrow*	Do. 2nd Class.	
309	*A. Nataraja Aiyar*	Do. 3rd Class.	
310	*K. Purushottama Raju*	Do. do.	

No.	Name.	Certificate.	Remarks.
	1886.		
311	*P. Subha Rau*	Surveyor, 3rd Class.	
312	*D. Venkatachalapati*	Do. 2nd Class.	
313	S. Raza Husain	Do 1st Class	Prize.
314	John Moran Berlie	Do. do.	
315	D. Setu Rau	Do. 2nd Class.	
316	A. Piraisudiya Pillai	Do. do.	
317	George Clifford Dalgairns	Do. do.	
318	B. Venkataramana	Do. do.	
319	H. Ignatius Lawrence	Do. 3rd Class.	
320	James Alexander Bowie	Do. 2nd Class.	
321	F. W. William Lears	Do. 3rd Class.	
322	A. S. Hudson	Do. do.	
323	N. Balasundara Nayakar	Do. do.	
324	*H. R. White*	Do. 2nd Class.	
325	*Gustav Haller*	Do. do.	
326	*Timothy Allan Johnson*	Do. 3rd Class.	
327	*K. Venkatasubhayya*	Do. 2nd Class.	
328	*M. Tiruvenkata Chariar*	Do. do.	
329	*C. Peramayya*	Do. 3rd Class.	
330	*C. Achyutaramayya*	Do. do.	
331	*T. Narasinga Rau*	Do. do.	
	May 1887.		
332	C. C. Somasundra Mudaliyar	Surveyor, 1st Class	Prize.
333	Anthoni Pereira	Do. 2nd Class.	
334	E. C. S. Stuart	Do. do.	
335	M. Ganesa Aiyur	Do. 3rd Class.	
336	V. Padmanabha Aiyangar	Do. do.	
337	C. K. Swaminatha Aiyar	Do. do.	
338	G. Pallamraju	Do. do.	
339	W. N. Wheatley	Do. do.	
340	N. Guruswami Aiyar	Do. do.	
341	M. Arumukha Pillai	Do. do.	
342	C. Duraiswami Nayudu	Do. do.	
343	Saiyid Murtuza Husain	Do. do.	
344	K. Thomas Varugese	Do. do.	
345	V. Lakshmana Rau	Do. do.	
346	P. Chandrasekhara Pillai	Do. do.	
347	Gnanaprakasa Pillai	Do. do.	Passed from the Engineer Subordinate Class.
348	*N. A. Thathayya Nayudu*	Do. 2nd Class.	
349	*S. K. Pattabhirama Aiyar*	Do. 3rd Class.	
350	*W. C. H. Littlewood*	Do. do.	
351	*M. Krishnayya*	Do. do.	
352	*G. Narayanaswami Nayudu*	Do. do.	

Surveyors.

No.	Name.	Certificate.	Remarks.
	Dec. 1887.		
353	V. Sambasiva Aiyar	Surveyor, 3rd Class	Silver medal.
354	N. Ammanna	Do. do.	
	1888.		
355	E. A. Ramaswami Aiyar	Surveyor, 3rd Class	Silver medal. Prize for Theod. Survg. and Levelling.
356	G. Gopalakrishna Aiyar	Do. do.	Prize for Topo. Drawing and Chain Surveying.
357	K. R. Krishnaswami Aiyar	Do. do.	
358	G. Nageswara Rau	Do. do.	
359	P. Rama Rau	Do. do.	
	1889.		
360	B. S. Ranganayakulu Nayudu	Surveyor, 2nd Class	Bronze medal. Prize for General Proficiency.
361	C. Bhujanga Rau	Do. 3rd Class.	
362	*T. Periaswami Pillai*	Do. do.	
	1890.		
363	K. Vyasa Rau	Surveyor, 1st Class	Bronze medal. Prize for Theod. Survg. and Levelling; Chain, &c., Surveying. Sir Madhava Rau Prize for Practical Surveying.
364	G. Gopalaswami Nayudu	Do. do.	Prize for Topo. Drawing.
365	V. Subha Rau	Do. 2nd Class.	
366	V. Kodandarama Sastri	Do. 3rd Class.	
367	T. Balasubrahmanya Aiyar	Do. do.	
368	*P. Duraiswami Nayudu*	Do do.	
	1891.		
369	C. Muttukrishna Mudaliyar	Surveyor, 1st Class	Bronze medal. Prize for Levelling and Topo. Drawing.
370	T. S. Vasudeva Aiyar	Do. 2nd Class	Prize for Chain, &c., and Theod. Survg.

No.	Name.	Certificate.	Remarks.
371	S. Tirumalai Aiyar	Surveyor, 2nd Class.	
372	A. Sundareswara Aiyar	Do. do.	
373	T. A. Ekambara Pillai	Do. do.	
374	K. S. Kuppuswami Aiyar	Do. do.	
375	L. R. Thiksha Aiyar	Do. do.	
376	G. Varatha Rau	Do. do.	
377	V. M. Jambulinga Mudaliyar	Do. do.	
378	L. N. Appadurai Aiyar	Do. 3rd Class.	
379	A. Arokiaswami Pillai	Do. do.	
380	*L. N. Sitarama Aiyar*	Do. do.	
381	*T. Royal Pillai*	Do. do.	
	1892.		
382	M. V. Sivasubrahmanya Aiyar	Surveyor, 2nd Class	Bronze medal. Prize for Surveying.
383	K. Kulothunga Pillai	Do. do.	Prize for Surveying.
384	C. N Ramaswami Aiyar	Do. do.	
385	D. Francis	Do. do.	
386	K. Rajagopalachari	Do. do.	
387	E. V. Venkatarama Dikshatar	Do. 3rd Class.	
388	T. R. Swaminatha Aiyar	Do. do.	
389	E. R. Aiyaswami Aiyar	Do. do.	
390	K. Venkataramana Aiyar	Do. do.	
391	M. A. Vaidyanatha Aiyar	Do. do.	
392	E. S. Venkatarama Aiyar	Do. do.	
393	Saiyid Abdus Salam	Do. do.	
394	C. Jagga Rau Chetti	Do. do.	
395	T. V. Ramachandra Rau	Do. do.	
396	R. Sankaranarayana Aiyar	Do. do.	
397	A. Venkataramana Rau	Do. do.	
	1893.		
398	G. Venkatarama Aiyar	Surveyor, 2nd Class	Bronze medal. Prize for Surveying.
399	G. Somayya Sastri	Do. do.	Prize for Surveying.
400	K. P. Sadasiva Aiyar	Do. do.	
401	T. R Jivanna Rau	Do. do.	
402	N Suriyanarayana	Do. 3rd Class.	
403	B. R. Ramakrishna Aiyang	Do. do.	
404	E. A. Ambasankara Aiyar ar	Do do.	
405	N. Rangaswami Aiyar	Do. do.	
406	V. Venkateswara Aiyar	Do. do.	
407	S. R. Muttuswami Aiyar	Do. do.	
408	A. Venkatachari	Do. do.	
409	A. R. Natesa Aiyar	Do. do.	

Surveyors.

No.	Name.	Certificate.	Remarks.
	1894.		
410	R. Natesa Aiyar	Surveyor, 2nd Class	Bronze medal. Prize for General Proficiency.
411	V. S. Pranatartihara Aiyar	Do. do.	Prize for General Proficiency.
412	T. K. Anantarama Aiyar	Do. do.	
413	T. Subrahmanya Pillai	Do. do.	
414	A. Sambamurti Aiyar	Do. do.	
415	P. K. Sundaresa Sastri	Do. do.	
416	A. V. Natesa Aiyar	Do. 3rd Class.	
417	P. V. Kuppuswami Aiyar	Do. do.	
418	A. C. Duraiswami Mudaliyar	Do. do.	
419	G. M. Govindaswami Aiyar	Do. do.	
420	V. P. Subrahmanya Aiyar	Do. do.	
421	V. Narayanaswami Aiyar	Do. do.	
422	C. S. Subrahmanya Aiyar	Do. do.	
423	N. P. Narayana Aiyar	Do. do.	
424	K. Pasupati Aiyar	Do. do.	
425	K. Venkata Rau	Do. do.	
426	K. N. Aiyadurai Aiyar	Do. do.	
427	A. M. Narayana Aiyar	Do. do.	
428	T. K. Muhammad Zain-ul-abidin.	Do. do.	
429	K. Satagopayya	Do. do.	
430	*E. A. Ramaswami Aiyar*	Do. do.	
431	*C. Govindaraja Mudaliar*	Do. do.	
432	*A. Mohanavelu Mudaliar*	Do. do.	
	1895.		
433	V. Rangaswami Mudaliyar	Surveyor, 2nd Class	Bronze medal. Prize for Surveying.
434	T. Venkoba Rau (Periyár)	Do. do.	Prize for Surveying. Sir Madhava Rau prize for Survey Field-work.
435	V. Kamayya Sastri	Do. 3rd Class.	
436	P. S. Gopala Rau	Do. do.	
437	S. R. Narayanaswami Aiyar	Do. do.	
438	M. S. Krishna Aiyar	Do. do.	
439	M. Apparau Nayudu	Do. do.	
440	K. B. Ethirajulu Nayudu	Do. do.	
441	G. V. Subrahmanya Aiyar	Do. do.	
442	R. Vaikunta Sarma	Do. do.	
443	M. Raghava Aiyangar	Do. do.	
444	T. Venkoba Rau (Madura)	Do. do.	
445	N. S. Ramachandra Aiyar	Do. do.	
446	P. S. Abdul Jabbar	Do. do.	
447	L. A. Annadurai Aiyar	Do. do.	
448	V. Devasenatipati Mudaliyar	Do. do.	
449	*M. V. Tygaraja Sarma*	Do. do.	

LIST OF STUDENTS WHO PASSED THE FINAL EXAMINATIONS OF DECEMBER 1894.

Engineers.

		Workshop Course.	Works Course.
S. A. Jagadisa Aiyar, B.A.	2nd class	1895	1896
K. V. Natesa Aiyar, B.A.	Do.	do.	do.

Engineer Subordinates.

J. S. Muttayya	2nd class	1895	1896
K. Narayana Hebbar	Do.	do.	do.
M. Krishnaswami Aiyangar	Do.	do.	do.
N. V. Suriyanarayana Aiyar	Do.	do.	do.
A. Krishna Pillai	Do.	do.	do.
V. Ramachandra Aiyar	Do.	do.	do.
Sergeant R. Cuthbert	Do.	do.	do.
S. Krishnaswami Aiyar	Do.	do.	do.
C. V. Narayanaswami Aiyar	Do.	do.	do.
C. Tirumala Chari	Do.	do.	do.
M. Doraisawami Aiyar	Do.	do.	do.
M. Ganapati Aiyar	Do.	do.	do.
N. S. Ramachandra Sastri	Do.	do.	do.
A. M. Narayanaswami Aiyar	Do.	do.	do.
Gunner R. Sheridan	Do.	do.	do.
T S. Visvanatha Aiyar	Do.	do	do.
T. Dinadayalu Mudaliyar	Do.	do.	do.

Draftsmen.

A. Kuppuswami Aiyangar	Third-class	certificate.
A. V. Rajabathar Mudaliyar	Do.	do.
K. Chinnaswami Nayudu	Do.	do.
S. Subrahmanya Aiyar	Do.	do.
S. K. Srinivasa Aiyangar	Do.	do.
H. I. Gnanaveram	Do.	do.
T. V. Venugopala Chetti	Do.	do.
P. V. Hanumanta Rau	Do.	do.
T. P. Lakshmana Aiyar	Do.	do.
A. Ponnuthorai Pillai	Do.	do.
D. V. Krishnayya	Do.	do.
M. Singaravelu Chetti	Do.	do.
C. K. Krishna Rau	Do.	do.
D. Kotayya	Do.	do.
T. Parankusam Nayudu	Do.	do
N. L. Ramachandra Rau	First-class	do.
T. R. Krishnaswami Aiyar	Second-class	do.
A. Mariasusai Pillai	Third-class	do.

T. Krishna Rau	Third-class	certificate.
K. Krishnama Chari	Do.	do.
T. Ranganatha Mudaliyar	Do.	do.
S. Purandra Rau	Do.	do.
G. Kamaraju	Do.	do.
K. Lakshmikanta Rau	Do.	do.
V. Aravamuthu Chari	Do.	do.
G. Kasturi Chetti	Do.	do.
G. V. Balakrishna Chetti	Do.	do.
N. Ragunatha Rau	Do.	do.

Surveyors.

R. Natesa Aiyar	Second-class	certificate.
V. S. Pranatartihara Aiyar	Do.	do.
T. K. Anantarama Aiyar	Do.	do.
T. Subrahmanya Pillai	Do.	do.
A. Sambamurti Aiyar	Do.	do.
P. K. Sundaresa Sastri	Do.	do.
A. V. Natesa Aiyar	Third-class	do.
P. V. Kuppuswami Aiyar	Do.	do.
A. C. Duraiswami Mudaliyar	Do.	do.
G. M. Govindaswami Aiyar	Do.	do.
V. P. Subrahmanya Aiyar	Do.	do.
V. Narayanaswami Aiyar	Do.	do.
C. S. Subrahmanya Aiyar	Do.	do.
N. P. Narayana Aiyar	Do.	do.
K. Pasupati Aiyar	Do.	do.
K. Venkata Rau	Do.	do.
K. N. Aiyadurai Aiyar	Do.	do.
A. M. Narayana Aiyar	Do.	do.
T. K. Muhammad Zain-ul-abidin	Do.	do.
K. Satagopayya	Do.	do.
E. A. Ramaswami Aiyar	Do.	do.
C. Govindaraja Mudaliyar	Do.	do.
A. Mohanavelu Mudaliyar	Do.	do.

LIST OF STUDENTS WHO PASSED THE FINAL EXAMINATIONS OF DECEMBER 1895.

Engineers.		Practical Course.
P. V. Manicka Nayakar	Second-class.	1896.
Y. Asvathanarayana	Do.	do.
D. Koil Pillai	Do.	do.
K. Subrahmanya Aiyar	Do.	do.
K. K. Thanu Pillai	Do.	do.
T. C. Kuppuswami Sastri	Do.	do.

Engineer Subordinates.		Practical Course.
S. Natesa Aiyar	First-class.	1896.
V. K. Kuppuswami Aiyar	Second-class.	do.
R. Srinivasa Raghava Chari	Do.	do.
G. Lakshmana Rau	Do.	do.
T. Ramaswami Aiyar	Do.	do.
Sergeant P. P. Dillon	Do.	do.
K. K. Narayana Aiyar	Do.	do.
Drummer J. Whittaker	Do.	do.
R. Narayanaswami Aiyar	Do.	do.
K. R. Venkatarama Aiyar	Do.	do.
V. Nataraja Mudaliyar	Do.	do.
R. S. Lakshmirata Aiyar	Do.	do.
M. Narayanaswami Aiyar	Do.	do.
G. Nilakanta Aiyar	Do.	do.
N. Krishnaswami Aiyar	Do.	do.

Draftsmen.		
S. Sandanam Pillai	First-class	certificate.
S. Gaurisankara Sarma	Do.	do.
T. Krishnaswami Mudaliyar	Do.	do.
V. M. Duraiswami Mudaliyar	Second-class	do.
A. Arulraya Pillai	Do.	do.
N. Anantarama Pillai	Do.	do.
V. C. Krishnaswami Mudaliyar	Third-class	certificate.
A. Varadaraja Aiyar	Do.	do.
K. Venkataranga Rau	Do.	do.
C. P. Susayanatha Mudaliyar	Do.	do.
D. Suriyanarayana	Do.	do.
G. Sriramulu	Do.	do.
S. J. Abraham Mudali	Do.	do.
C. Duraiswami Reddi	Do.	do.
S. Narasimhayya	Do.	do.
K. Ramaswami Aiyar	Do.	do.

S. Lakshminarayana	Third-class	certificate.
W. Kannuswami Mudaliyar	Do.	do.
S. Sriramulu Nayudu	Do.	do.
W. Rajagopala Mudaliyar	Do.	do
A. V. Rajabathar Mudaliyar	First-class	do.
T. Narayana Aiyangar	Second-class	do.
A. Parvatisam	Do.	do.
R. Chidambara Mudaliyar	Do.	do.
A. Vodiaperumal Nayudu	Third-class	do.
V. K. Ramaswami Pillai	Do.	do.
S. Srinivasa Chari	Do.	do.
A. Sundara Varatha Chari	Do.	do.
D. D. Winfred	Do.	do.

Surveyors.

V. Rangaswami Mudaliyar	Second-class	certificate.
T. Venkoba Rau (Periyar)	Do.	do.
V. Kamayya Sastri	Third-class	do.
P. S. Gopala Rau	Do.	do.
S. R. Narayanaswami Aiyar	Do.	do.
M. S. Krishna Aiyar	Do.	do.
M. Apparau Nayudu	Do.	do.
K. B. Ethirajulu Nayudu	Do.	do.
G. V. Subrahmanya Aiyar	Do.	do.
R. Vaikunta Sarma	Do.	do.
M. Raghava Aiyangar	Do.	do.
T. Venkoba Rau (Madura)	Do.	do.
N. S. Ramachandra Aiyar	Do.	do.
P. S. Abdul Jabbar	Do.	do.
L. A. Annadurai Aiyar	Do.	do.
V. Devasenatipati Mudaliyar	Do.	do.
M. V. Tygaraja Sarma	Do.	do.

No. 1285 C.

MADRAS,
31st *January* 1896.

From

THE PRINCIPAL,
College of Engineering,
Madras,

To

THE DIRECTOR OF PUBLIC INSTRUCTION,
Madras.

SIR,

I have the honour to submit the following review of the working of the College of Engineering during the year 1895.

2. *Establishment.*—The only change which occurred in the establishment was that due to my return from furlough, and re-assumption of the principalship from Mr. J. P. Davidson on 1st April. Application has been made to Government for an extension of the period during which the services of Sergeant B. O. Reynolds, Instructor in Engineering, are lent to the College. The principle of establishing a chain of responsibility among the members of the staff was extended by placing each assistant instructor under the control, so far as his work is concerned, of one of the two chief instructors. The plan has been found to answer well.

3. *Numbers.*—The numbers on the rolls at the end of the session were—

Class.	Practical course.		In college.			Total.
	Second year.	First year.	First division.	Second division.	Third division.	
Engineer classes ...	3	2	7	6	6	24
Engineer Subordinate class *	26	17	22	19	22	106
Military probationers ...	...	...	...	...	...	2
Draftsman class ...	...	...	* 34	30	...	64
Surveyor class	...	...	† 26	22	...	48
Artisan class	...	...	...	...	...	35
Total ...	...	...	...	...	...	279

* Including 6 } who, for examination purposes, were classed as independent
† Including 8 } candidates.

Excluding the students going through the practical courses in workshops and on works, the total number actually in the College on 31st

December 1895 was 231. The corresponding totals for the four preceding years were 1894, 265; 1893, 252; 1892, 217; 1891, 189. The reduction in numbers, as compared with those of 1894, is due partly to a falling off in the competition for the Engineer Subordinate class, partly to the abnormal strength of the senior divisions of the Draftsman and Surveyor classes of 1894, and partly to casualties. I expect a recovery to take place during 1896.

The distribution of the students by classes of the community, by districts of the Presidency, and by wealth and occupation of parents are given in appendices A and B.

The numbers offering for admission were: Engineer classes 13, of whom 11 passed the entrance examination of December 1895; Engineer Subordinate class 31, of whom 25 qualified in April for admission; Draftsman and Surveyor classes 66 and 46, respectively, of whom 48 and 38 qualified in December 1895; Artisan class 103, of whom 40 have been selected.

4. *Examinations.*—The final and term examinations were conducted, as usual, by the Board of Examiners, with Mr. Ashpitel as President. A brief abstract of the results is given below:—

(*a*) *Engineer Classes.*—The first division contained 7 third-year students, 6 of whom passed the final examination. The second and third divisions, numbering 6 each, passed the usual term examinations.

(*b*) *Engineer Subordinate Class.*—The senior division of 21 students appeared for the final examination, and 15 were successful. S. Natesa Aiyer who heads the list with more than three-fourths of the total marks, is the first native student to pass this examination in the first class. Four independent candidates also appeared, none of whom passed. The second and third divisions of 19 and 22, respectively, passed the usual term examinations.

(*c*) *Draftsman Class.*—The senior division consisted of 28 students, of whom 20 qualified, viz., 3 for first-class certificates, 3 for second-class, and 14 for third-class certificates. These results show a great improvement over those of 1894. Thirty-one independent candidates presented themselves, of whom 20 passed, viz., 1 for a first-class certificate, 4 for second-class, and 15 for third-class certificates. Twelve of these successful candidates are however already certificate holders. The second division of 30 students passed a fair term examination.

(*d*) *Surveyor Class.*—The first division of 22 students appeared for the final examination, and 16 passed, viz., 2 for second-class and 14 for third-class certificates. Eleven independent candidates presented themselves, and 1 was successful, gaining a third-class certificate. The second division of the class, numbering 22, passed a good term examination.

(*e*) *Artisan Class.*—This class, which opened with 40 students, fell through resignations and dismissals to 35 at the close of the year. Evening instruction was imparted as usual, and the class, judging from the large number of applications for admission, continues popular. It is reserved, as far as possible, for maistries, artisans and the sons of such persons.

The class percentages of the marks under the various subject-heads compare as follows with the average results of the preceding four years:—

Engineer Classes.	1895.	Average of previous four years.
Mathematics	57	65
Science	45	51
Engineering	51	66
Drawing	55	71
Surveying	61	69
Language	58	54
Drills and Exercises	62	72
Total	54	64
Engineer Subordinate Class.		
Mathematics	51	48
Engineering	47	50
Drawing	60	55
Surveying	59	56
Language	37	48
Drills and Exercises	70	71
Total	54	54
Draftsman Class.		
Practical Geometry	66	61
Free-hand, Perspective and Model Drawing.	57	56
Building Drawing	56	57
Machine Drawing	58	55
Estimating	48	48
Topographical Drawing	50	51
Drills and Exercises	53	71
Total	55	56
Surveyor Class.		
Chain Compass and Plane Table Surveying	52	58
Levelling	59	63
Theodolite Surveying	43	61
Topographical Drawing	54	56
Drills and Exercises	68	67
Total	54	60

The usual proportion of the total marks was assigned by the College staff for session work and practical examinations, and the whole of the marks for drills and exercises.

The classes show great uniformity in the final results, each obtaining 54 or 55 per cent. of the total marks.

5. *Practical Courses.*—Three Engineer students and 24 Engineer Subordinate students completed their works course on 31st December. Another Engineer Subordinate will finish his course at the end of February. The Senior Engineer student, R. N. Arogyaswami Mudaliyar, B.A., B.C.E., obtains the guaranteed appointment as Assistant

Engineer, Public Works Department. Another Engineer student belonging to a previous year completed his course in May. The reports received from Executive Engineers are generally favourable to the progress of the students. There is a tendency in some divisions to employ the students chiefly on Survey work, which does not afford the complete training for which the course is designed. No reports were received regarding 3 students attached to the Madura and Tinnevelly divisions.

Two Engineer students and 17 Engineer Subordinate students completed their course in the Public Works Workshops on 31st December. Among the latter were 2 casualties, 1 by death and 1 by resignation. All the students went through a course of riding in the Body Guard School. One Engineer Subordinate student sustained a serious riding accident, but he has since recovered. The progress reports from the Superintendent of the Public Works Workshops were satisfactory. It has been suggested to the Superintendent that the working hours should be increased to thirty per week. One of the Engineer students was permitted to spend two months of his course in the College Workshop.

It has been determined, with the view of diminishing the present duration of the full curricula, to reduce the practical course from two years to one, the Chief Engineer deciding in individual cases on the division of the period between workshops and works. It is probable that the whole of the period will usually be spent on works, the training in workshop practice being given in the College shops during the theoretical course. The immediate effect of the alteration will be that two batches of Engineers and Engineer Subordinates will complete their course simultaneously in December 1896. To avoid this it has been suggested that the students of the earlier year shall be deemed to finish their course on 30th June. With the practical abolition of the Workshop year, special arrangements will have to be made for the riding course.

The course in workshops for Mechanical Engineer students will also, it is understood, be reduced to one year.

6. *Military Students.*—The total number of soldier students on 31st December 1895 was 11, viz., 2 on works, 2 in workshops, 5 in the Engineer Subordinate class, and 2 probationers. One probationer was remanded to his regiment in July for failure to pass the examination, and 1 regular student in September for misconduct.

It has been notified that the probationary course will be reduced from one year to six months for the next three years, and thereafter abolished completely, the entrance examination being raised to the standard required for civil candidates. The admissions are to be 5 per annum, and 2 appointments are guaranteed.

7. *Government Technical Examinations.*—Of the College regular students who voluntarily appeared for the Government Examinations in Engineering subjects, 1 passed the *Advanced* standard, 6 the *Intermediate*, viz., 4 in the first and 2 in the second class, and 5 the *Elementary*, viz., 2 in the first and 3 in the second class. The decision that Government Technical scholarships cannot be held during the College practical courses, will probably materially affect the number of students appearing for these examinations.

8. *Surveying.*—During February, two divisions of the Engineer class, two of the Engineer Subordinate class, and one of the Surveyor class, comprising 82 students, were encamped at Guindy for a fortnight's continuous work. In July, three divisions of the Engineer class, two of the Engineer Subordinate class, and one of the Surveyor class, numbering 65 in all, proceeded to Guduvancheri for three weeks for further practice. The work was done under the skilful superintendence of Sergeant Goddard, the Instructor in Surveying and Drawing, and was, on the whole, satisfactory; attention being paid more to accuracy of detail than to magnitude of outturn. Marks were allotted for the work then done, and practical examinations of all the classes in Surveying were held in November by the College staff. These examinations, on which great stress is laid, have proved of high value in encouraging knowledge of the manipulation of surveying instruments. It is intended to have the camps next year at Avadi, and to send out the whole of the Engineer, Engineer Subordinate and Surveyor classes.

9. *Estimating.*—The results in estimating have always been low throughout the College. In 1894 wholesale failure occurred in this subject in the Draftsman class. Investigation showed that College marks had been insufficiently assigned; and, with the approval of the Board of Examiners and the sanction of Government, these marks were raised so as to correspond with those given by the Board. The result was that 5 additional students qualified as Draftsmen of the third class. Great attention has been devoted to Estimating during the year under review. Under the special direction of Sergeant Reynolds, the Instructor in Engineering, estimates were given to all the classes as vacation tasks, numbers were worked by each individual student, especially those of the Draftsman class, and carefully examined and checked; numerous examinations were held, and on many occasions holidays were compulsorily utilised. The Board of Examiners handsomely recognise the progress which has been made.

10. *Inspection of Works.*—In addition to the usual inspections of buildings, bridges, and factories, a tour was made by 86 students of the Engineer, Engineer Subordinate, and Draftsman classes to a portion of the Pálár Irrigation system in North Arcot. Useful assistance was kindly rendered by Mr. H. E. Clerk, the Executive Engineer of that division. The Principal was permitted to visit the Periyár on the occasion of the opening of the works in October. Inspections of the Lawrence Asylum, Ootacamund, and of the Albert Victor Technical Institute at Trichinopoly were made by Mr. Chatterton, Professor of Engineering, under the orders of the Director of Public Instruction.

11. *Workshops.*—The Professor of Engineering, who is in charge of the Workshops, reports that the Engineer and Engineer Subordinate classes attended the shops as usual, and that, though none of them displayed remarkable aptitude for mechanical work, several did very fairly. Two wood-turning lathes with wooden beds, and one small iron foot lathe were constructed, but only a few of the students could be put on this work, and most of the finishing was done by the instructors. A considerable amount of carpentry work was executed for the College, comprising benches, almirahs, drawing tables and stools, in which the students participated. When the contemplated revision of the syllabuses has been made, it is hoped that more time will be devoted to workshop

practice, and that the advantages of the shops may be extended to the Draftsman and Surveyor classes.

The boiler was out of use for several months owing to damage to the tubes caused, it is believed, by foul water. Pending re-tubing, a small portable engine was hired from the Public Works Workshops. It is in contemplation to build an extension at the south end of the shops, to transfer the engine and boiler thither, and to convert the existing boiler room into a forge.

The 100-ton testing machine was delivered in Madras towards the end of 1894; but questions having arisen with regard to the site proposed, its erection was delayed. It is expected that the foundations will be put in early in 1896.

12. *Museum.*—The College is indebted to Mr. Upcott, the Consulting Engineer for Railways, for the presentation of several models connected with the erection of the Kistna Bridge at Bezwada.

13. *Revision of Rules.*—The revision of the syllabuses was taken in hand in March by a committee consisting of—

Mr. J. P. Davidson, Acting Principal.
Mr. H. C. West, Chief Engineer, Madras Railway.
Mr. R. E. Ellis, Engineer to the Municipality.
Mr. A. Chatterton, Professor of Engineering.
M.R Ry. B. Hanumanta Rau, Acting Professor of Mathematics.

Besides recommending certain reductions in the syllabuses, the committee proposed that, in view of the permanent establishment of Sub-overseers likely to be created for the Public Works and Revenue Departments, the present Surveyor class should be developed into a class for Sub-overseers. The matter is still under the consideration of Government.

The reduction of the practical course for Engineer and Engineer Subordinate students from two years to one has already been adverted to.

To give further encouragement to the Engineer class, the tuition term fee has been reduced from Rs. 80 to Rs. 68, while the scholarships tenable in each division for one year have been increased from one of Rs. 30 to three of Rs. 15.

The riding course was made compulsory for all students to be appointed to the Engineer or Upper Subordinate establishment of the Public Works Department, the fees being payable by the students.

The above changes take effect from 1st January 1896.

Under the Provincial Service Rules (Public Works Department) the annual guaranteed appointment to the Engineer class will be made to the grade of Apprentice Engineer. Government have been pleased to order that the apprenticeship shall run from the termination of the theoretical course, and that it shall ordinarily last one year. This ruling applies to the batches which joined the College during and after 1893.

14. *Physical Training and Recreation.*—The additional land on the west side of the canal, which was placed at the disposal of the College in 1894, was levelled, and the whole ground is now used for both cricket and foot-ball. The College Recreation Club was placed on a satisfactory footing, and membership made compulsory, the fee payable being Rs. 2

per term. The Club maintains branches for *Reading Room*, *Cricket*, *Foot-ball* and *Lawn Tennis*, and is managed by the students with a member of the staff as Honorary Secretary. Considerable progress was made with cricket, and many matches were played; but the game is not cultivated by the native students as much as it should be. Encouragement was offered by allowing regular players to make good any deficiency of marks for gymnastics and drill up to a limit of 25 per cent. of the maximum. Teams were entered for the Brandt-Hutchins Trophy and the Inter-Collegiate Trophy matches. In the latter there were four wins and five losses down to the close of the year. Foot-ball has proved popular with a large number of students, but no matches have been played. Tennis is played regularly by a small number.

Instruction in drill and gymnastics was given as usual. The drill is generally slack and unsatisfactory, and more attention must be paid to it in future. One Drill Instructor, Sergeant England, has however taken great pains with his classes. I regard the drill practice as valuable not only physically but morally, as it teaches the practice of instant and unquestioning obedience to an order.

15. *Library.*—During the year 70 books were added to the Library, which now contains 3,225 volumes. The books issued to the students numbered 2,396, and to the staff 453; while 853 references were made to the Consulting Library. These figures show very marked reduction in the use of the Library since 1894. I attribute this result to the high pressure at which work has been conducted during 1895, and to the want of leisure for private reading from which the students have suffered in consequence. The preparation of a new catalogue was undertaken by M.R.Ry. M. Anantalwar under the supervision of M.R.Ry. B. Hanumanta Rau. The work is now in the press.

16. *College Buildings.*—An allotment for extended accommodation was made in the Public Works Budget for the year 1895–96. The Consulting Architect has prepared plans and estimates for the construction of a new west front to the old portion of the building; but up to the end of 1895 no sanction had been accorded. It would be advantageous if new quarters could be built for the Superintendent of Military students, the rooms he now occupies on the ground floor of the old building being handed over to the soldier students.

17. *Attendance and Conduct.*—The percentage of numbers present to numbers on the rolls was 94·6 for the Engineer and Engineer Subordinate classes, and 93·0 for the junior classes. As regards the conduct of the students I regret that I am unable to report in the usual favourable manner. The number of entries for disobedience of orders, deceit, inattention and idleness, and absence without leave, was unprecedented. The majority of cases occurred in the Draftsman and Surveyor classes; but the Engineer Subordinate class shows a record which is by no means unblemished. The want of discipline extended itself to the Military students, and it was not until two acting Non-commissioned officers had been deprived of their lance stripes, and one of them remanded to his regiment, while stringent measures were taken with recalcitrant civil students, that the general behaviour became, towards the close of the year, again unexceptionable. Precautions were taken to prevent a recurrence of the unfair practices at examination of which cases were reported in 1894.

18. *Health.*—The College did not escape the general unhealthiness for which the year has been noticeable in Madras. There was an extraordinary amount of absence through sickness, properly supported by medical certificates. I regret to report no less than four casualties by death, viz., 1 Engineer Subordinate student in the Public Works Workshops, 2 college students of the same class, and 1 of the Draftsman class.

19. *University Examinations.*—Two candidates appeared for and passed the B.E. degree examination of 1895, both of whom were third-year students of the Engineer class. Nine candidates appeared for the F.E. examination, and 7 passed. Six of the 7 were second-year students of the Engineer class. Of the 2 who failed, 1 was a second-year and 1 a third-year student.

20. *Financial Details.*—The total expenditure for the calendar year 1895, exclusive of capital charges and repairs to buildings, amounted to Rs. 72,080 and the income from fees, &c., to Rs. 14,190. Detailed statements of receipts and charges are given in Appendices D and E, but the figures will probably not agree exactly with those of the Accountant-General. I take this opportunity of enquiring whether these statements and those of distribution of students are necessary in future, seeing that full information is furnished in the annual returns for the official year.

The falling off in the receipts during 1894, which was commented on in the review of the report for that year was apparent only, and was due to sums pertaining to 1892 being credited to the receipts of 1893.

21. *Employment of passed students of* 1894.—Of the 3 Engineer students who completed their practical course on 31st December 1894, the senior G. S. Rama Aiyar, B.A., B.C.E., was appointed Assistant Engineer in the Public Works Department; and the other 2 accepted posts as Upper Subordinates, 1 being permanent and the other temporary.

Of the 10 Engineer Subordinate students, who qualified for diplomas, 7 were appointed to the permanent, and 2 to the temporary Upper Subordinate establishment of the Public Works Department, while the remaining student, who was the first in his batch, accepted employment in the Public Works Department of Travancore.

Of the 15 Draftsmen, 8 are known to have obtained employment of a temporary or permanent character on salaries ranging from Rs. 20 to Rs. 45.

Of the 20 surveyors, 14 have reported appointment on salaries ranging from Rs. 20 to Rs. 60, viz., 8 by the Public Works Department, 2 under Municipalities, 1 by a Local Board, 1 in the River Conservancy establishment, and 2 by the Sivagunga Zemindary.

22. *Prospects of employment.*—I regard the prospects of employment in the immediate future as exceptionally good. The large batch of 24 Engineer Subordinates who completed their practical course on 31st December 1895 was preceded by three small batches, nearly all the members of which were absorbed by the Public Works Department. Those of the present batch, whose services are not required by the department, are therefore likely to have little difficulty in obtaining employment under other departments and Local Boards. Seventeen, however, have already been appointed to or offered employment in the Public

Works Department and 1 in a Railway Survey. Again, a large permanent establishment of Sub-overseers is likely to be required shortly for the Tank Restoration Scheme; and it is possible that Sub-overseers in considerable numbers may also be needed in the Revenue Department. It will be two, perhaps, three years before the College can turn out persons specially trained for these posts. In the meantime, appointments must be made from the best material now available.

The vacancies notified during the year in the Gazette, the public press and by letter to the Principal, were one-hundred and twenty-five in number, of which forty-nine were under Government, thirty-three under Local Boards and Municipalities, twenty-five on railways, seven under Native States, and eleven under private employers. Ten of the vacancies were for Engineers and Assistants, three for Supervisors, thirty-seven for Overseers, twenty for Draftsmen, twenty-seven for Surveyors, eighteen for lower subordinates, and two for maistries, while the remainder were of a miscellaneous character. Nine of the appointments carried salaries of Rs. 200 and upwards, four between Rs. 100 and Rs. 200, sixty-four between Rs. 50 and Rs. 150, and forty-eight under Rs. 50. Particulars are given in Appendix C.

23. *General Remarks.*—I desire to thank Mr. Ashpitel, the President of the Board of Examiners, for the uniform courtesy, consideration and promptness which he has displayed in all examination matters. I also acknowledge the cordial co-operation of Mr. Chatterton, the Professor of Engineering, and of M.R.Ry. B. Hanumanta Rau, the Acting Professor of Mathematics, with me in the work of the College. I further record the help given by the Instructor in Surveying and Drawing, and the Instructor in Engineering, and their respective assistants. I make special mention of the energy displayed by Sergeant Goddard in regard to the surveying work throughout the College, and by Sergeant Reynolds in developing the teaching of Estimating and in the management of the Pálár tour and numerous inspections of works. Sergeant Goddard, as the Honorary Secretary of the Recreation Club and the guiding spirit in the cricket field, earns the gratitude of the students for his leadership in their games, as well as my own thanks for his devotion to the work of the College.

I have the honour to be,
Sir,
Your most obedient servant,

H. D. LOVE, Major, R.E.,
Principal.

APPENDIX A.

Distribution of Students by Wealth and Occupations of Parents.

Classes in college.	Wealth.				Occupation.								
	Richer classes.	Middle classes.	Poorer classes.	Total.	Officials.	Petty officials.	Traders.	Landholders.	Artisans.	Coolies including agricultural labourers.	Mendicants.	Others.	Total.
Engineer classes ...	1	17	1	19	9	1	...	8	...	...	1	...	19
Engineer Subordinate classes	1	55	7	63	19	6	1	36	1	...	...	...	63
Military probationers.	...	2	...	2	2	...	...	...	...	..	.	...	2
Draftsman classes ...	...	55	9	64	35	5	5	17	2	...	..	...	64
Surveyor classes ...	2	41	5	48	21	4	3	20	...	...	.	...	48
Artisan class ...	1	19	15	35	19	5	4	3	4	...	...	.	35
Total ...	5	189	37	231	105	21	13	84	7	...	1	...	231

APPENDIX B.

Distribution of Students by Districts.

—	Engineer classes.	Engineer subordinate classes.	Military probationers.	Draftsman classes.	Surveyor classes.	Artisan Classes.	Total.
Ganjám	...	...	...	...	1	...	1
Vizagapatam	1	...	...	1	1	...	3
Gódávari	...	2	...	...	5	...	7
Kistna	...	...	...	8	1	...	9
Nellore	...	1	...	1	3	...	5
Cuddapah	...	...	...	...	...	2	2
Anantapur	...	...	...	1	...	...	1
Bellary	...	...	...	...	...	...	...
Kurnool	...	...	...	1	1	...	2
Madras	5	21	...	14	12	20	72
Chingleput	...	1	...	...	...	2	3
North Arcot	...	1	...	5	...	...	6
South Arcot	...	...	...	...	...	...	...
Tanjore	3	17	...	8	6	2	36
Trichinopoly	1	1	...	14	5	...	21
Madura	1	6	...	1	5	...	13
Tinnevelly	...	1	...	1	3	..	5
Coimbatore	...	...	...	2	2	5	9
Nilgiris	...	...	...	...	...	...	...
Salem	1	...	...	2	1	2	6
South Canara	...	1	..	1	...	...	2
Malabar	...	3	.	1	...	...	4
Cochin	...	...	...	...	1	...	1
Coorg	...	...	...	2	...	...	2
Mysore including Bangalore ...	6	...	...	1	1	2	10
Trivandrum	1	3	...	...	...	...	4
Military probationers	...	5	2	...	...	...	7
Total ...	19	63	2	64	48	35	231

APPENDIX C.

Classification of Vacancies notified during the year 1895.

Vacancies.	Government.			Local Boards and Municipalities.				Railways.				Native States.			Private employers.		Total.
	Rs. 100 to 200	Rs. 50 to 100.	Under Rs. 50.	Above Rs. 200.	Rs. 100 to 200.	Rs. 50 to 100.	Under Rs. 50.	Above Rs. 200.	Rs. 150 to 200.	Rs 50 to 150.	Under Rs. 50.	Rs. 100 to 200	Rs. 50 to 100.	Under Rs. 50.	Rs. 50 to 100.	Under Rs. 50.	
Engineer or Assistant	...	...	...	9	1	...	...	...	...	...	...	...	...	...	...	...	10
Supervisor	..	...	...	.	3	...	...	...	...	...	...	..	...	...	...	...	3
Overseer	...	3	.	..	...	11	7	...	...	2	6	...	1	...	6	1	37
Draftsman	...	2	7	...	...	..	...	..	...	5	4	...	...	1	...	1	20
Surveyor	...	18	...	...	...	1	...	..	..	2	..	...	4	1	...	1	27
Sub-overseer	...	6	10	...	...	...	.	...	...	...	2	...	...	...	...	...	18
Maistry	...	...	1	...	...	...	...	...	...	...	...	...	..	...	...	1	2
Anicut Superintendent	...	...	2	...	..	...	...	...	...	...	...	...	...	...	...	1	3
Tracer	...	...	...	..	..	...	...	...	...	...	1	...	...	...	...	...	1
Drawing Master	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	1
Permanent Way Inspectors	...	...	...	...	...	...	...	...	...	3	...	...	...	...	...	...	3
Total ...	...	29	20	9	4	12	8	...	...	12	13	...	5	2	6	5	125

APPENDIX D.

Detailed Statement of the receipts for the Calendar year 1895.

Months.	Tuition fees.	Entrance and examination fees.	Fines, &c.	Total.
	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.
January 1895 ...	......	......	......	......
February „ ...	4,506 0 0	......	......	4,506 0 0
March „ ...	......	1,073 8 0	93 10 0	1,167 2 0
April „ ...	278 8 0	......	......	278 8 0
May „ ...	85 0 0	......	......	85 0 0
June „ ...	......	......	......	......
July „ ...	5,325 0 0	......	......	5,325 0 0
August „ ...	107 0 0	......	......	107 0 0
September „ ...	72 0 0	10 0 0	......	82 0 0
October „ ...	60 0 0	754 0 2	......	814 0 0
November „ ...	......	1,166 0 0	......	1,166 0 0
December „ ...	71 0 0	440 0 0	148 8 10	659 8 10
Total ...	10,504 8 0	3,443 8 0	242 2 10	14,190 2 10

APPENDIX E.

Detailed Statement of the Charges for the Calendar year 1895.

—	Principal.			Professors, Masters, and Teachers.			Clerks, librarian and servants.			Board of Examiners.			Library and prize allowances.			Books and instruments.		
1	2			3			4			5			6			7		
	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.
January 1895 ...	1,000	0	0	1,652	0	0	......			250	0	0	......			......		
February „ ...	1,000	0	0	2,514	0	0	265	0	0	......			101	10	4	......		
March „ ...	1,000	0	0	2,534	0	0	336	12	0	.....			......			194	12	2
April „ ...	1,000	0	0	2,591	8	0	257	0	0	......			......			......		
May „ ...	1,240	14	0	2,560	0	0	249	15	0	......			......			......		
June „ ...	1,240	14	0	2,556	0	0	268	0	0	......			5	8	0	......		
July „ ...	1,240	14	0	2,556	0	0	268	0	0	4,502	8	0	......			......		
August „ ...	1,240	14	0	2,576	0	0	279	12	0	......			433	13	9	......		
September „ ...	1,240	14	0	2,576	0	0	279	6	9	......			8	0	0	234	6	0
October „ ...	1,240	14	0	2,594	0	0	279	10	0	......			34	6	1	......		
November „ ...	1,240	14	0	2,580	0	0	271	1	10	......			......			2	8	0
December „ ...	1,240	14	0	2,580	0	0	271	7	0	.. ...			4	8	0	30	9	0
Total ...	13,927	0	0	29,869	8	0	3,029	0	7	4,752	8	0	587	14	2	429	12	2

APPENDIX E—*cont.*

***Detailed Statement of the Charges for the Calendar year* 1895—continued.**

—	Miscellaneous.			Travelling allowances.			Exchange compensation allowances.			Scholarships.			Other Europe stores.			Total.		
	8			9			10			11			12			13		
	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.
January 1895 ...	194	6	8	......			407	4	0	242	0	0	......			3,745	10	8
February „ ...	83	1	6	......			439	8	3	40	0	0	* 695	2	10	5,138	6	11
March „ ...	1,279	12	7	......			439	8	3	324	0	0	4,317	9	9	10,426	6	9
April „ ...	0	12	1	58	8	0	640	12	0	182	0	0	......			4,730	8	1
May „ ...	0	4	9	......			572	6	8	182	0	0	......			4,805	8	5
June „ ...	......			......			571	10	5	322	0	0	4	12	2	4,978	12	7
July „ ...	......			......			497	6	8	212	0	0	......			9,276	12	8
August „ ...	100	0	5	169	12	0	500	15	5	232	0	0	......			5,533	3	7
September „	† 1,227	11	5	250	4	0	500	15	5	232	0	0	......			6,549	9	7
October „ ...	......			12	12	0	510	0	0	213	0	6	......			4,884	10	7
November „ ...	919	3	10	229	4	0	510	0	0	221	10	6	......			5,974	10	2
December „ ...	1,147	2	0	......			510	0	0	220	11	6	......			6,035	12	6
Total ...	4,952	7	3	720	8	0	6,100	7	1	2,633	6	6	5,017	8	9	72,080	0	6

* Excluding Rs. 22,885, capital charges on workshops.

† Excluding Rs. 2,561, capital charges on workshops.

ABSTRACT OF MARKS

AWARDED AT THE FINAL EXAMINATIONS OF DECEMBER 1895.

ENGINEER CLASS.

Abstract of Marks.

Rank.	Names.	I. Mathematics.	II. Science.	III. Engineering.	IV. Drawing.	V. Surveying.	VI. Language.	VII. Drills and Exercises.	Total.	Remarks.
	Maximum Marks ...	475	525	775	500	400	200	125	3,000	
	College Students.									
1	P. V. Manicka Nayakar	267	283	525	363	301	129	85	1,953	Passed Second Class.
2	Y. Asvathanarayana	282	249	438	266	243	122	75	1,675	Do. do.
3	D. Koil Pillai	223	233	451	291	260	101	95	1,654	Do. do.
4	K. Subrahmanya Aiyar	294	188	401	305	248	108	85	1,629	Do. do.
5	K. K. Thanu Pillai	307	259	325	242	247	120	100	1,600	Do. do.
6	T. C. Kuppuswami Sastri	303	238	324	241	221	115	60	1,502	Do. do.
7	M. S. Mangaleswara Aiyar ..	215	191	308	215	185	117	40	1,271	Failed in Total.
	Average per cent. ..	56·9	44·7	51·1	54·9	60·9	58·0	61·7	53·7	

ENGINEER SUBORDINATE CLASS.

Abstract of Marks.

Rank.	Names.	I. Mathematics.	II. Engineering.	III. Drawing.	IV. Surveying.	V. Language.	VI. Drills and Exercises.	Total.	Remarks.
	Maximum Marks ...	370	600	400	350	180	100	2,000	
	College Students.								
1	S. Natesa Aiyar	327	444	318	266	90	75	1,520	Passed First Class.
2	V. K. Kuppuswami Aiyar	239	458	335	293	90	50	1,465	Do. Second Class.
3	R. Srinivasa Raghava Chari	215	326	308	224	106	100	1,279	Do. do.
4	G. Lakshmana Rau	238	362	261	258	90	55	1,264	Do. do.
5	T. Ramaswami Aiyar	255	309	302	227	59	95	1,247	Do. do.
6	Sergeant T. P. Dillon	188	366	266	254	64	85	1,223	Do. do.
7	K. K. Narayana Aiyar	195	315	292	257	102	40	1,201	Do. do.
8	Drummer J. Whittaker	147	335	301	219	57	95	1,154	Do. do.
9	R. Narayanaswami Aiyar	229	320	228	227	90	50	1,144	Do. do.
10	K. R. Venkatarama Aiyar	187	289	260	207	60	75	1,078	Do. do.

11	V. Nataraja Mudaliyar	217	247	222	182	65	85	1,018	Do. do.
12	R. S. Lakshmirata Aiyar	159	312	230	156	100	60	1,017	Do. do.
13	M. Narayanaswami Aiyar	152	258	227	211	100	60	1,008	Do. do.
14	G. Nilakanta Aiyar	150	252	232	208	80	80	1,002	Do. do.
15	N. Krishnaswami Aiyar	148	255	215	234	79	70	1,001	Do. do.
16	P. K. Srinivasa Chari	156	196	208	156	90	80	886	Failed in II and Total.
17	S. Krishnaswami Aiyar	198	211	135	165	67	60	836	Do. in Total.
18	L. V. Narayanaswami Sarma	164	235	153	161	63	60	836	Do. do.
19	C. Duraiswami Pillai	128	226	222	152	49	55	832	Do. do.
20	M. Muthuvadivelu Mudaliyar	147	217	186	150	54	70	824	Do. do.
21	G. Chandrasekharam	133	160	139	116	71	65	684	Do. in II, IV and Total.
	Average per cent. ...	51·1	48·4	60·0	58·8	43·0	69·8	53·6	
	Independent Candidates.								
1	M. Visvanatha Aiyar	131	221	192	186	70	63	863	Failed in Total.
2	R. Umamaheswara Aiyar	178	203	161	142	108	47	839	Do. do.
3	M. S. Ramanatha Aiyar	142	192	178	156	93	56	817	Do. do.
4	A. S. Lakshmana Aiyar	96	194	152	139	103	49	733	Do. in I, II and Total.
	Average per cent. ...	36·9	33·7	42·7	44·5	51·9	53·7	40·6	

DRAFTSMAN CLASS.

Abstract of Marks.

Rank.	Names.	I. Geometrical Drawing.	III. Free-hand Perspective and Model Drawing.	III. Building Drawing.	IV. Machine Drawing.	V. Estimating.	VI. Topographical Drawing.	VII. Drills and Exercises.	Total.	Remarks.
	Maximum Marks ...	100	120	270	200	180	80	50	1,000	
	College Students.									
1	S. Sandanam Pillai	96	90	242	163	128	55	43	817	Passed First Class.
2	V. M. Duraiswami Mudaliyar ..	92	108	229	163	108	57	23	780	Do. Second Class.
3	S. Gaurisankara Sarma	77	113	211	158	120	66	25	770	Do. First Class.
4	T. Krishnaswami Mudaliyar ...	85	98	201	150	119	55	45	753	Do. do.
5	A. J. Arulraya Pillai	69	85	191	148	92	59	35	679	Do. Second Class.
6	N. Anantarama Pillai	69	83	205	124	102	51	27	661	Do. do.
7	V. C. Krishnaswami Mudaliyar ...	75	90	181	132	80	41	38	637	Do. Third Class.
8	A. Varadaraja Aiyar	80	78	177	103	103	49	30	620	Do. do.
9	K. Venkataranga Rau	61	81	155	123	93	50	33	596	Do. do.
10	C. P. Susayanatha Mudaliyar ...	66	102	160	94	89	39	30	580	Do. do.
11	D. Suriyanarayana	66	74	147	129	86	40	28	570	Do. do.
12	G. Sriramulu	62	67	158	98	101	49	13	548	Do. do.
13	S. J. Abraham Mudali	67	48	138	113	132	34	15	547	Do. do.
14	C. Duraiswami Reddi	60	68	125	134	72	36	44	539	Do. do.
15	S. Narasimhayya	60	88	128	116	89	42	10	533	Do. do.
16	K. Ramaswami Aiyar	76	56	127	136	68	29	38	530	Do. do.
17	S. Lakshminarayana	59	60	108	107	121	37	33	525	Do. do.
18	W. Kannuswami Mudaliyar ...	68	43	142	110	94	28	38	523	Do. do.
19	S. Sriramulu Nayudu	67	50	128	113	85	31	30	504	Do. do.

20	W. Rajagopala Mudaliyar	60	60	127	119	83	34	20	503	Do. do.
21	N. Hanuman Singh	67	60	127	101	72	30	22	479	Failed in Total.
22	W. Ranganatha Mudaliyar ...	56	55	151	120	50	26	18	476	Do. in V and Total.
23	K. Deva Rau	49	66	143	99	82	33	...	472	Do. in Total.
24	M. R. Narayana Aiyar	59	60	138	129	47	37	2	472	Do. in V and Total.
25	K. Annadurai Aiyar	62	45	128	94	70	34	25	458	Do. in Total.
26	C. Venkatasubba Rau Nayudu ...	51	45	89	59	79	31	28	382	Do. in III, IV and Total.
27	C. Venkatapati Nayudu	40	41	101	77	58	34	20	371	Do. in II, V and Total.
28	G. Suriyaprakasa Rau	42	10	56	24	27	12	10	181	Do. in II, III, IV, V and Total.
	Average per cent. ...	65·7	57·3	55·7	57·8	48·6	49·9	51·6	55·4	
	***** *Independent Candidates.*									
1	A. V. Rajabathar Mudaliyar ...	72	80	213	162	122	67	43	759	Passed First Class.
2	T. Narayana Aiyangar	57	90	195	155	90	56	32	675	Do. Second Class.
3	A. Parvatisam	79	87	172	160	91	* 53	24	666	Do. do.
4	R. Chidambara Mudaliyar ...	80	82	180	121	99	58	43	663	Do. do.
5	A. Vodiaperumal Nayudu ...	66	69	199	130	72	63	41	640	Do. Third Class.
6	V. K. Ramaswami Pillai	64	77	176	95	85	50	16	559	Do. do.
7	S. Srinivasa Chari	54	70	141	105	76	43	40	529	Do. do.
8	A. Sundara Varada Chari	55	45	147	100	109	36	29	521	Do. do.
9	D. D. Winfred	37	52	149	100	79	38	48	503	Do. do.
10	P. Kandaswami Mudaliyar ...	55	50	138	90	83	24	24	464	Failed in Total.
11	Saiyid Abdul Jalil	40	44	153	107	23	40	41	448	Do. in V and Total.
12	T. Arunachala Mudaliyar ...	40	59	114	90	68	31	24	417	Do. in Total.
13	Turab Husain	71	26	111	50	53	38	42	391	Do. in II, IV, V and Total.
14	S. Amirtalinga Aiyar	45	35	112	75	43	43	30	383	Do. in II, V and Total.
15	C. Kolandavelu Pillai	48	45	97	55	29	22	19	315	Do. in IV, V and Total.
16	T. S. Seshayya	30	49	82	49	19	31	30	290	Do. in I, III, IV, V and Total.
17	K. Sundara Pandiam Pillai ...	..	35	44	34	43	22	17	202	Do. in I, II, III, IV, V and Total.

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* As the names of certain candidates who, holding certificates, did not secure certificates for higher class, have been omitted from this list, no average percentages are shown.

SURVEYOR CLASS.

Abstract of Marks.

Rank.	Names.	I. Chain, Compass and Plane Table Surveying.	II. Levelling.	III. Theodolite Surveying.	IV. Topographical Drawing.	V. Drills and Exercises.	Total.	Remarks.
	Maximum Marks ...	255	215	200	280	50	1,000	
	College Students.							
1	V. Rangaswami Mudaliyar	175	156	107	197	39	674	Passed in Second Class.
2	T. Venkoba Rau (Periyar)	169	174	108	174	43	668	Do. do.
3	V. Kamayya Sastri	152	170	112	174	28	636	Do. Third Class.
4	P. S. Gopala Rau	163	149	97	183	27	619	Do. do.
5	S. R. Narayanaswami Aiyar	165	120	103	175	50	613	Do. do.
6	M. S. Krishna Aiyar	130	138	95	193	50	606	Do. do.
7	M. Apparau Nayudu	157	130	107	161	40	595	Do. do.
8	K. B. Ethirajulu Nayudu	155	137	83	161	45	581	Do. do.
9	G. V. Subrahmanya Aiyar	113	156	89	159	50	567	Do. do.
10	R. Vaikunta Sarma	115	153	130	128	30	556	Do. do.
11	M. Raghava Aiyangar	109	144	81	157	50	541	Do. do.
12	T. Venkoba Rau (Madura)	137	138	71	161	33	540	Do. do.
13	N. S. Ramachandra Aiyar	160	110	103	116	43	532	Do. do.
14	P. S. Abdul Jabbar	131	114	72	157	40	514	Do. do.
15	L. A Annadurai Aiyar	144	123	72	156	15	510	Do. do.
16	V. Devasenatipati Mudaliyar	127	110	91	160	12	500	Do. do.
17	T. G. Rajagopala Nayudu	122	109	66	141	20	458	Failed in Total.
18	M. R. Ramaswami Aiyar	109	106	82	125	32	454	Do. do.
19	P. M. Chinnaswami Aiyar	98	100	57	142	35	432	Do. in III and Total.

20	T. K. Swaminatha Aiyar	100	98	51	124	40	413	Do. in Total.
21	E. A. Vaidyanatha Aiyar	104	43	58	132	23	360	Do. in II and Total.
22	K. M. Kuppu Rau	96	101	65	81	7	350	Do. in Total.
	Average per cent. .	52·2	58·8	43·2	54·5	68·4	53·3	
	Independent Candidates.							
1	M. V. Tyagaraja Sarma	128	119	120	103	33	503	Passed Third Class.
2	M. Parvatisam	153	88	86	121	29	477	Failed in Total.
3	C. R. Ranga Chari	141	92	66	110	26	435	Do. in III and Total.
4	K. Krishnama Chari	92	137	53	83	43	408	Do. in III, IV and Total.
5	J. Krishna Rau	133	87	75	72	36	403	Do. in IV and Total.
6	G. Venkataseshadri	91	118	64	112	2	387	Do. in I and Total.
7	N. N. Karney	75	110	85	88	27	385	Do. in I, IV and Total.
8	O. Krishnaswami	117	86	55	68	20	346	Do. in III, IV and Total.
9	P. Kuppuswami Mudaliyar	55	20	26	51	5	157	Do. in I, II, III, IV and Total.
	Average per cent. ...	42 9	44·3	35·0	32·1	49·1	38·9	

EXAMINATION PAPERS.

I. FINAL AND TERM EXAMINATIONS, DECEMBER 1895.

DIFFERENTIAL AND INTEGRAL CALCULUS. *Time*—3 hours.

Engineer Class, 1st Division.

1. Explain what is meant by a differential coefficient; and find from first principles the differential coefficients of (1) $\tan x + \sec x$; (2) $\tan^{-1}\frac{x}{a}$.

2. Find the differential coefficients of

$$(1)\ \frac{x\sqrt{x^2-4a^2}}{\sqrt{x^2-a^2}};\quad (2)\left(1+\frac{1}{x}\right)^x;\ (3)\left(\tan x\right)^{\tan x}.$$

3. Enunciate and prove Leibnitz's theorem for the n^{th} differential coefficient of the product of two functions.

Find the n^{th} differential coefficient of $\frac{1}{x^2+(a+b)x+ab}$.

4. Investigate the conditions which must be satisfied in order that a given function of x may have a maximum or minimum value.

An open cistern is to be constructed with a square base and vertical sides, so as to contain a given quantity of water. Show that the expense of lining it with lead will be least if the depth is made half of the width.

5. Find the asymptotes of the curve $(a^2-2ay)(3y^2-x^2) = 2(x^4-y^4)$, and the directions of the tangents at the origin.

6. Trace the curves—

$$ax(y-x)^2 - y^4 = 0;$$
$$x(x^2-ay)^2 - y^5 = 0.$$

7. Evaluate

$$\int\frac{dx}{x^2-a^2};\int\frac{dx}{5+4\sin x};\int\frac{x\,e^{a\tan^{-1}x}}{(1+x^2)^{\frac{3}{2}}}dx;$$

$$\int_0^{\frac{\pi}{2}}\cos^5 x dx;\quad \int_0^{\infty}\frac{(e^{ax}+e^{-ax})(e^{bx}+e^{-bx})}{e^{\pi x}+e^{-\pi x}}dx.$$

8. Describe any form of integrator and give the theory of the instrument.

9. Find the moment of inertia of a right circular hollow cylinder relative to its axis.

Engineer Class, 1st Division.

CHEMISTRY. *Time*—2 hours.

1. Give a brief sketch of the atomic theory.

2. What are the two chief constituents of the air, and in what proportions do they occur? How may it be demonstrated that they occur in the air as a mechanical mixture?

3. How does bromine occur in nature? How can it be obtained pure? What are its physical and chemical characters?

4. How would you prepare and collect some ammonia gas and demonstrate its most important properties?

5. What are the principal tests to which water is subjected in order to determine its impurities?

6. If calcium hydrate is soluble in 730 times its mass of water, what volume of carbon dioxide at 85° F. is required to precipitate the calcium from a kilogram of lime water?

$$Ca = 40,\ C = 12,\ H = 1,\ O = 16.$$

APPLIED MECHANICS. *Time*—4 hours.

1. Two tie bars (or ropes), one double the length of the other, either of which can safely support 2 tons, have their upper ends fixed, one practically vertically above the other, so that their lower ends are attached to the same point of a certain weight. What is the greatest weight they can together safely support?

2. A wrought iron bar of rectangular section $3'' \times 1''$ transmits a tensile force of 5 tons, whose line of action lies in the middle of one of the smaller sides and is parallel to the mean fibre. Required the maximum intensities of stress of both senses?

Find the position of the neutral axis, and what would be the intensity of stress if the line of action coincided with the mean fibre?

3. Calculate both exactly and approximately the moment of inertia of a double T wrought iron beam, whose extreme depth is 14 inches, web $\frac{1}{2}$ inch thick, flanges 5 inches × $\frac{8}{10}$ inches? Suppose a beam of this section to be 16 feet between supports, find the weight of a concentrated load 4 feet from one of the supports, which neglecting the beam iron weight will produce the limiting intensity of stress of 6 tons per square inch.

4. Find the diameter of a shaft to transmit 200 H.P. at 100 revolutions per minute, the limiting intensity of shearing stress being 9,000 lb. per square inch.

5. What are the conditions of stability of a plane joined in masonry?

If the material of a wall weighs 130 lb. per cubic foot and the coefficient of friction of the joint is 1; to what height above the base will the joints be stable against horizontal sliding, supposing the wall to be 20 feet high, 14 inches thick, and subject to a horizontal thrust of 400 lb. per foot run at its top.

Engineer Class, 1st Division.

6. A Warren girder of 150 feet span is divided into 10 bays; the bars of the web are inclined at 60.° The girder carries a fixed load of $\frac{3}{4}$ ton per foot run and a moving load of $1\frac{1}{4}$ ton per foot, both to be assumed acting on the joints of the bottom boom.

Find the maximum stress occurring on the fifth strut and on the fourth bay of each boom.

7. Find the stresses in each member of a King Post roof truss, using the following data :—

The common rafters are carried on purlins which in turn are supported at the top, centre, and bottom of each principal.

The struts abut at the centre of each principal.

Span between centres of bearings ..	30 feet.
Distance between principals ..	10 feet.
Inclination of principals	30°
Fixed load on roof per square foot of horizontal surface covered ..	10 lb.
Horizontal wind pressure per square foot of vertical surface	40 lb.

NOTE.—The meaning of all symbols in any formula used must be clearly defined.

MECHANISM AND THE STEAM ENGINE. *Time*—3 hours.

1. A stationary engine runs at 62 revolutions per minute and drives a line of shafting from which 90 H.P. is taken off by various machines. The shafting runs twice the speed of the engine. What must be the width of the belt, state also whether single or double, and the diameters of the pullies on the shafting and on the engine? Coefficient for belt friction to be taken as ·27.

2. A planing machine bed is driven by a single-thread screw with one-inch pitch, this screw being driven from the driving spindle by bevil gearing arranged to give a return of the table at twice the forward or cutting speed. Allowing a cutting speed of 18 feet a minute, what must be the numbers of teeth in the wheels and the speed of the driving spindle or shaft? Also how long will it take to plane up a surface of 8 square feet allowing a feed of 14 cut to the inch.

3. A screw press with a table 3′ 0″ × 1′ 6″ and screw 8″ diameter is used for pressing cotton. The nut is turned by a capstan with 8 bars each 6′ 6″ long. The pitch of the screw is 1″. Assuming one man on each bar is exerting a pressure of 80 lb. and a coefficient for friction of ·002, what pressure per square inch is put upon the bale of cotton?

4. I want a high pressure stationary engine to develop 50 H P. and to run at a speed of 80 revolutions per minute steam pressure in the steam chest 110 lb. per square inch. Give the diameter and stroke of the cylinder, diameter of crank bearing, grade of expansion you would recommend, and any other details of the engine you consider necessary.

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5. Describe generally the process of combustion giving the leading conditions that should be observed to ensure good results and as perfect transmission as possible of the heat contained in the coal to the water in a steam boiler.

6. What is meant by—

(*a*) A unit of heat.
(*b*) Saturated steam.
(*c*) Expansive working.
(*d*) Nominal horse power.
(*e*) Indicated horse power.

7. A Cornish boiler is 9′ 0″ diameter double rivetted throughout and made of best Yorkshire iron plates $\frac{9}{16}$″ thick. Allowing a factor of safety of 6, what should be the working pressure?

HYDRAULICS AND IRRIGATION WORKS. *Time*—4 hours.

1. Orders were recently issued that the duty of water issued for irrigation from the sluices of Red Hills tank should be determined and that arrangements should be made, in future, to regulate the issue of water according to the duty arrived at. How would you carry out these orders?

2. For gauging a small stream of varying flow what form of notch do you consider to be most suitable and why?

Find the discharge from a rectangular sharp-edged notch 10 feet long when the head measured from still-water is 6 inches. ($c = 0{\cdot}65$), and from a 60° triangular notch when the head is 8 inches. ($c = 0{\cdot}62$.)

3. Design a channel of minimum border to carry 96,000 cubic yards per hour with a fall of 1 foot per mile and side slopes 1 to 1. ($c = 82$.) Why are channels of minimum border not more often employed?

4. A stream has a catchment area of 50 square miles above a certain place where a dam, 200 feet long, with crest 3 feet above bed, has been constructed. During floods the depth of water in front and rear of the dam was 10 feet and 9 feet on the gauges and the mean velocity of the stream was found to be 5·66 feet per second. Determine the coefficient which should be used with Ryves' formula for the catchment area in question. $c = \frac{2}{3}$ for dam. Zero of gauges 3 feet below crest of dam.

How would you determine the mean velocity of the stream and what considerations govern the position of the gauges?

5. Describe the Italian module and show that the ratio of the heads above the orifices is unaffected by the change of water level in the canal.

6. A channel irrigates 45,000 acres and the duty of water is 90 acres per cubic foot per second. The fall is $\frac{1}{2500}$, depth of water $5\frac{1}{4}$ feet and side slopes 1 to 1. Determine the bed width. ($C = 74$.)

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7. At a certain point below the head of the channel in question 6 there is a drop of 5 feet in the bed level. Determine the height above bed in the upper reach to which the crest of the drop must be built in order that the water may be delivered into the lower reach with the normal channel velocity. Length of drop to be the same as the bed width of the channel. What should be the width of the apron?

8. Determine the theoretical profile of a masonry dam 10 feet high which contains the minimum area consistent with the condition that the lines of pressure, reservoir full and empty, limit the centre third of the profile. From this theoretical profile deduce the practical section you would adopt for the body wall of a tank weir 8 feet high, assuming that two feet of water pass over the crest and neglecting the tail water. Specific gravity of masonry = 2.

9. Find the discharge in gallons per hour of a straight pipe, one mile long and 18 inches diameter laid at a slope of 2 feet per mile, when the pressures per square inch at the two ends are 43·3 and 35·5 lb. respectively. (C = 106.)

If the end of the pipe is stopped by a plug what will be the pressure per square inch?

If a circular bend of 90° with a radius of 5 feet is inserted what addition must be made to the head?

TOPOGRAPHICAL DRAWING. *Time*—3 hours.

1. On the paper which you use for the sketch in question 3 print the following heading. The words to be suitably arranged and the letters of suitable form and size. The scale to be drawn and its representative fraction given :—

Topographical sketch. Scale $\frac{1}{\qquad\qquad}$

2. A drawing has no scale attached but a line on it, which measures 3½ inches, is figured 11½ feet. Make a scale for the drawing and construct a corresponding scale of metres. (One metre = 3·28 feet.) Write down the representative fraction.

3. A canal, which runs parallel to the coast about ½ mile from the sea, crosses a backwater which at the point of crossing is 6 furlongs wide. The backwater extends inland beyond the limits of the sketch and at the bar narrows down to a width of 330 feet. On the south margin of the backwater is a large village and a road, which terminates at a house near the bar, and, on the beach, ¼ mile south of this house is a small fishing village. The road has an avenue of tamarind trees and some of the outlying houses of the village are surrounded by cocoanut topes. The coast north and south of the bar between the sea and the canal is planted with casuarina trees. To the north of the backwater and west of the canal are salt pans 1½ acres in area and some wet cultivation. Make a sketch of the country thus described showing ½ mile of canal on each side of the backwater. Scale 8 inches to a mile.

4. Show half a square mile of hilly country (1) by contours, (2) by shading. Scale 12 inches to a mile.

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MACHINE DRAWING. *Time*—4 hours.

1. Draw half full size plan elevations and sections of a big end for a connecting rod, locomotive type, for a bearing 4″ long × 7″ diameter showing all details of brasses, straps, bolts and cotters.

2. Draw full size a head stock with spindle for a simple ungeared wood turning lathe 8″ centre with cone pulley for 3 speeds showing full details of the cone bearing for the spindle and the arrangement of the tail screw and nuts.

3. Draw to scale half size a section through the line *AB* of the locomotive sand box shown in the accompanying drawing.

4. Ink in and colour as much of No. 1 or No. 2 as time will permit.

BUILDING DRAWING (BRIDGES AND IRRIGATION WORKS).
Time—4 hours.

1. The accompanying drawing gives details of the girders for a 6 feet railway bridge. Make complete drawings of the bridge, assuming floor and top of foundations at + 10·00, top of abutments + 16·00. Splay wings with revetted returns and a packed rough-stone apron in rear to be provided. Foundation and floor to be concrete 2½ feet thick. All batters 1 in 6. The drawings to be fully dimensioned.

Drawings required—

(1) Elevation, plan, and cross section of girders to a scale 1½ feet to an inch.

(2) Elevation ½ in front ½ in rear, plan ½ at top ½ at floor level, ½ longitudinal and cross section of bridge to a scale 4 feet to an inch.

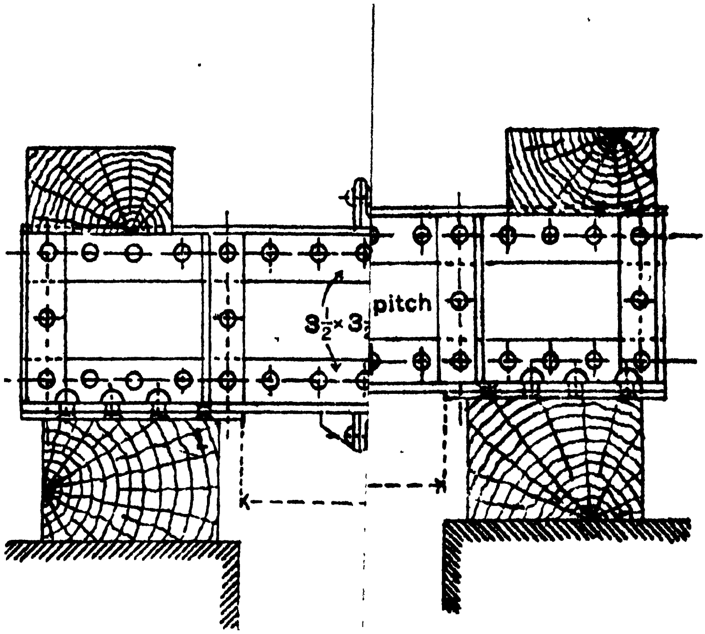
2. If you have time ink in and colour your drawings.

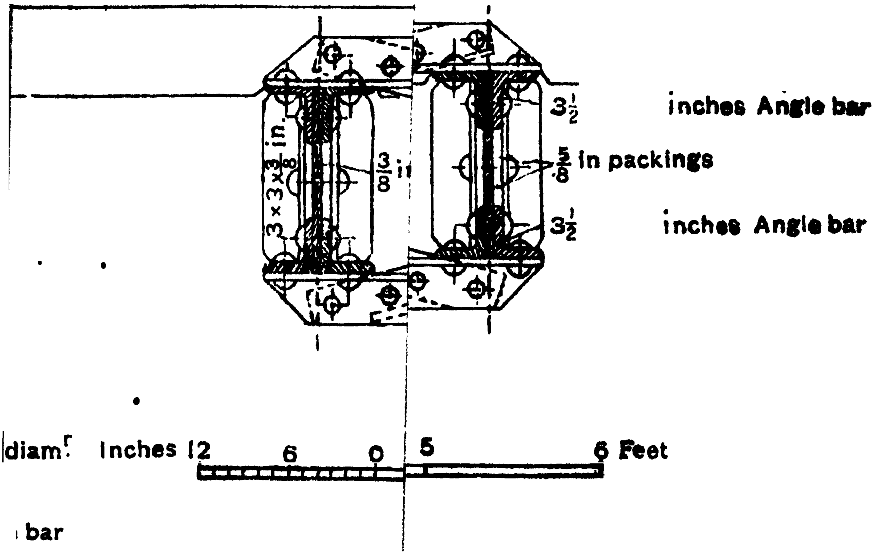
ESTIMATING. *Time*—4 hours.

Take out fully and in detail the quantities of each description of work (1) in the iron trough, (2) in the cook house shown on the accompanying drawings; abstract these in estimate form and estimate the cost.

SPECIFICATION EOR IRON TROUGH.

The trough to be of plate iron ⅛ inch thick (weight 5 lb. per square foot) stiffened with angle irons as shown. The trough to be painted. Iron work 3 annas per lb.; painting Rs. 4 per square. Note in the abstract the number of each size of rivet required, but so far as the estimate is concerned add to iron work 5 per cent. for rivets.


pitch
3½ × 3½


3 × 3 × ⅜ in.
⅜ in
3½ inches Angle bar
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bar

Builorks

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SPECIFICATION FOR COOK HOUSE.

Foundations.—To be as shown on the drawings.

Superstructure.—To be of brickwork.

Woodwork.—To be Burma teak.

Door.—A strong battened door fitted with a good lock to be provided.

Window.—To be fitted with a plank shutter.

Roof.—To be double-tiled (battens, 2½″ × 3½″; ridge batten, 4″ × 4½″; wall plates, 4″ × 3″).

Floor.—To be of stone flagging 1½″ thick laid on 2½″ concrete and 8″ rammed clay as shown. The door sill to be dressed stone.

Interior and exterior fittings.—The exterior of building to be pointed and the interior colour-washed. All woodwork to be painted two coats. The following fittings to be provided (1) a stone sink 2′ 6″ × 1′ 9″ × 4″ with a spout and receptacle as shown; (2) a water tank, 1′ 6″ × 1′ 6″ × 1′ 0″ of iron $\frac{1}{12}$ inch thick and provided with a brass cock; (3) one meat safe as shown; (4) one teak chopping block, 1′ 6″ × 1′ 1½″ × 1′ 0″.

Plinth protection.—To be of concrete as shown. Average thickness 5¼ inches.

RATES FOR COOK HOUSE.

Earthwork, Rs. 3–8–0 per 1,000 c. feet; concrete, Rs. 16 per 100 c. feet; rammed clay, Rs. 1–8–0 per 100 c. feet; brickwork (including archwork and pointing), Rs. 25 per 100 c. feet; cornice, As. 4 per running foot; dressed stone, Re. 1 per c. foot; stone flagging, As. 12 per sq. foot; colour-washing, As. 4 per square; double tiling, Rs. 12 per square; joinery, Rs. 1–8–0 per sq. foot; timber framed and fixed, Rs. 3–8–0 per c. foot; painting, Rs. 4 per square; iron work, As. 3 per lb.; earthen cooking range, Re. 1 per running foot; meat safe, Rs. 20; brass cock for water tank, Rs. 7.

THEODOLITE SURVEY. *Time*—3 hours.

1. Practical question (adjustments of theodolite).

2. It is proposed to put in a diversion 50 feet distant from and parallel to a main line of railway which is on the straight. The diversion is joined to the main line at either end by reverse curves 1,000 feet radius with 100 feet of straight between. Assuming the central straight portion of the diversion to be 1,000 feet in length, what will be the total length measured along the main line between the beginning and end of the diversion?

3. Explain how you would set out the diversion of question 2 practically on the ground.

4. The intersection of two straight lines makes an angle of 154° 30′. The tangent must be 432·16 feet in length. What will be the radius, versine and length of the curve?

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5. Compute by Gale's method the area of the following survey. Take the meridian through *A* as the base line of the plot :—

Observed angles.		Length.		Remarks.
F				
A	87° 48′	*AB*	1,202′	Bearing of line *AB* = 75° 32′ N.E.
B	144° 57′	*BC*	1,110′	
C	69° 32′	*CD*	850′	
D	120° 43′	*DE*	802′	
E	226° 50′	*EF*	705′	
F	70° 10′	*FA*	1,060′	
A				

6. The altitude of the top of an obelisk read at two points *A* and *B* in line with the obelisk is 44° 23′ and 35° 12′ respectively. The measured distance *A* to *B* is 250 feet and the altitude of the ground at *A* as read at *B* is + 5° 33′.

The height of the instrument at *A* was 4·23 feet and at *B* 4·75 feet. The reduced level of *B* is 100·29. What is the reduced level of the top of the obelisk?

TAMIL AND TELUGU. *Time*—3 hours.

1. Translate into Tamil or Telugu :

(*a*) *Tankwork.*—Stone revetment should never be less than 1′ 0″ thick, with a 6″ gravel backing, well watered and tamped. Before commencing work all gravel required for backing, jelly and quarry chips to the extent of ¼ cubic yard for every cubic yard of revetment work to be done, must be collected and stacked for measurement. The revetment to be repacked will then be marked with tar, and work commenced. The revetment to be repacked will be brought as near as possible to one level, to facilitate measurement, and the top stones tarred. No new stones will be brought to the work spot until the old revetment has been repacked, measured and tarred. New stone will be of the minimum size (1½ × 1½ × 1). If more than 10 per cent. of the stone collected is smaller than this it should be rejected. The stones will always be packed so that the thickness is made up by one stone, and the work should be done in lengths of 100 feet, and brought up layer by layer. As each layer is completed, the interstices must be filled up with jelly and the gravel backing to the required thickness put in, watered and tamped. The face of the revetment will be wedged with quarry chips.

(*b*) In the case of tanks having no stone revetment, a fringe of belal grass may be planted along the toe of the bund at least one yard wide and thickly. Turfing will be done as a rule during the north-east monsoon. The turf should be watered if necessary for three months, to enable the roots to pierce the subsoil. Payments only to be made after the growth is assured. The rate allows for watering.

(*c*) The houses in Japan consist of four perpendicular corner posts in a framework of wood surmounted by a thatched roof.

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interior can be divided at pleasure or thrown into one large hall simply by sliding along paper panels which serve for partition walls. When these are thick, it is a very comfortable plan and superior to our hinged doors. The floors are covered with mats delightfully soft to tread upon, as they are laid over a deep layer of straw and fit quite closely. The size of a room is reckoned by the number of mats it contains.

(d) To provide a healthy abode for children, the first thing to do is to make a wise selection of situation and aspect. Secure, if possible, a southern aspect and bear in mind the invaluable effect of sunshine. Next, take care to fill the centre or hollow between the basement walls with river sand to a foot or two beneath the floor to keep it dry, the native nurses being accustomed to wash it and walk barefooted. Let me first see the new bricks collected in one heap beside the stack of old bricks, at quarter to four to-morrow afternoon. I shall have none but the best bricks laid on the flooring.

2. Translate into English :

The following is for candidates who take up Tamil :

(a) எங்கள் கிராமத்திலிருக்கும் பெரிய ஏரிக்கு மூன்று மதகுகளுண்டு. கல்கட்டுவேலையில அதிகமாகச் செலவுசெய்து மூன்று மதகு கட்டுவானேன்? ஒன்றே போதாதா என்று அனுபவமில்லாத அந்நியதேசத்தார் கேட்பார்கள்.* இந்த ஏரி நீர்பாயும் நிலத்தின் மட்டம் ஒரே அளவாயிராமல் வெவ்வேறளவாயிருப்பதால், மேட்டுத்தாக்கில் பாய மேட்டுமதகும், பள்ளத்தாக்கில் பாய பள்ளமதகும் வேண்டுமென்று ஊரில் பெரியோர் சொல்லுகிறார்கள். ஆனால் மேட்டுமதகினாலேயே பள்ளத்தாக்கு நிலங்களுக்கும தண்ணீர் எளிதாகப் பாயாதா? பள்ளமதகு ஏதுக்கு என்று சிலர் கேட்கலாம். சாதாரணமாக நீர்பாயும் நிலம் எந்தத்தாக்கிலிருக்கிறதோ அதேதாக்கிலேதான் கரைபோட்டு ஏரியும் கட்டப்பட்டிருக்கின்றது. ஆகையால் ஏரி உள்வாயும் ஏரிகீழிருக்கும் பயிர்நிலமும் ஒரேமட்டமாகத்தானிருக்கும் - மேட்டுமதகுக்குமேலே ஜலமிருக்கிறவரையில் அதன் வழியாகத் தண்ணீர் பாய்ந்துகொண்டிருக்கும் - ஜலம் வடிந்துபோகப்போக அந்த மதகுக்கண்ணுக்குக் கீழே போய்விடுங்காலத்தில் அடியிலுள்ள தண்ணீர் முழுமையும் பாய்வதற்காகப் பள்ள மதகுகள் வேண்டியிருக்கின்றன. பயிரிடும் நிலங்களுக்கெல்லாம் உயர்ந்திருக்கும் மேட்டுத்தாக்கிலேயே ஏரி கட்டப்பட்டிருந்தால் அப்போது பள்ளமதகு ஒன்றுமாத்திரமே போதும்.

(b) அதற்குப்பின்பு குன்றுகளின்மீது கட்டப்பட்டிருந்த ஆலயங்களைப்போய் பார்த்தோம். இந்த ஆலயங்கள் ஆகாயமளாவிய ஆல், அரசு முதலான மரங்களடர்ந்த தோப்பின் நடுவே சிறிதும் பெரிதுமான துவஜஸ்தம்பங்களுடன் பிரகாசித்தன. அந்தத் துவஜஸ்தம்பங்களில் கடவுள் துதியான வாக்கியங்கள் பதிப்பித்த காகிதங்களை கொடிகளாகக் கட்டப்படும். செங்குத்தான குன்றுமேல் ஏறி அந்த ஆலயங்களுக்குப் போகவேண்டியவர்கள் வெகுதூரம் படிக்கட்டுகள் ஏறிப்போகவேண்டும். அந்த ஆலயங்களோ மிகப்பெரிய கட்டடங்கள்; பருத்த சுவர்களின்மேல் விரிவாக மரத்தினால் தளம்போட்டு மூடப்பட்டிருந்தன. சுற்றிலும் சுந்தரமான விருக்ஷங்களும் பூஞ்செடிகளும் நிறைந்திருந்ததால் நடுப்பகலிலேகூட

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வெயில் உக்கிரமாகக் காயாமல், சந்தியாகால வெளிச்சம்போலவே சாந்தமாயிருக்கும்.

(*c*) இப்பொழுது காற்றுமழையடித்து வெள்ளம்புரண்டு சாலைகளில் மரங்கள் விழுந்து பருக்காங்கல்பாறை பலவிடங்களில் அறுக்கப்பட்டு எல்லாம் மேடுபள்ளமாகப் போயிற்று. அங்கே தரை மணலாயிருப்பதனால், முதலாவது உடைந்த செங்கல்களும் பிறகு நூறுவண்டி பருக்காங்கல்லும் கொண்டுவந்து சேர்த்து வேலை ஆரம்பிக்கவேண்டும். சில விடங்களில் கொஞ்சம் களிப்பான களிமண் பரப்பித்தான் கல்கொட்டித் திமிசுபோடவேண்டியது. பாதைபோகும் கால்வாய்க்கரை மேட்டில் புல்போடவேண்டும். வண்டிகள் இடைவிடாமல் போகிறதும் வருகிறதுமான சாலையாதலால் அதைச் சீக்கிரத்தில் மரமத்துசெய்து சமப்படுத்தவேண்டும். ஒருசக்கரக் கைவண்டிகள், கோடாலி, மண்வெட்டி, கட்டப்பாரை முதலான ஆயுதங்கள் நாளை மற்றைநாளுக்குள் கிடங்கிலிருந்து வந்து சேரும்படி உத்திரவுபண்ணுவேன்.

2. Translate into English:

The following is for candidates who take up Telugu:

(*a*) మా గ్రామమునందు పెద్ద చెరువునకు మూడు తూములు గలవు. గచ్చురనికై అధిక వ్యయముచేసి మూడు తూములు కట్టనేల? ఒకటి చాలదా? అని యనుభవముచాలని పరదేశస్థులు అడుగుదురు. ఆ చెఱువునీటి పారుదలక్రింద నుండు భూమియొక్క మట్టము ఒకటేవిధముగానుండక వ్యత్యాసముగా నుండుటచేత మెట్ట భూమిమీద పాఱుటకు పైతూమును, పల్లపునేలమీద పాఱుటకు క్రింది తూమును, కావలసియుండునని ఊరియందలి పెద్దలు చెప్పుచున్నారు. ఐనను మెట్టతూమువలననే పల్లపునేలకుగూడ నీరు చులకనగా పాఱగూడదా? పల్లపుతూము మఱియొకటి యెందుకు? అని కొందఱు అడుగవచ్చును. పొలములు ఏ మట్టముననున్నవో ఆ మట్టమునుండియే కట్టపోసి చెరువు ఏర్పఱుతురు. కాబట్టి చెరువు లోతట్టునేలయు చెరువు క్రిందిపొలమును ఒకటేరీతిగా నుండును. మెట్టతూమునకు పైగా జలముండువఱకు దానిగుండా నీరు పాఱుచుండును. జలము తీసిపోనుపోను ఆ తూము ద్వారముకంటె క్రిందికి తగ్గిపోవునపుడు ఆ చెరువుయొక్క అడుగుననుండు నీరంతయు పాఱుటకై క్రిందితూములు కావలసియుండును.

(*b*) ఆవల కొండ గుట్టలమీద కట్టబడియున్న ఆలయములను పోయి చూచితిమి. ఈ యాలయములు ఆకాశమును దాకుచుండు మఱ్ఱిచెట్లును రావిచెట్లును గల తోపు నడుమను చిన్నవి పెద్దవిగానుండు ధ్వజస్తంభములతో ప్రకాశించుచున్నవి. ఆ ధ్వజస్తంభములమీద దేవస్తుతులు ముద్రించియున్న కాకితములు ధ్వజపటములుగా కట్టబడును. నైఋత్యముగానుండు కొండయెక్కి ఆ యాలయములకు పోగోరువారు కడుదూరము వఱకు మెట్లమీదనే యెక్కిపోవలయును. ఆ యాలయములు దళమయిన గోడలమీద మానులతో కప్పి విశాలమయిన మిద్దవేసిన పెద్దపెద్ద మందిరములు; చుట్టును రమణీయమయిన వృక్షములు పూదీగెలును నిబిడముగా నుండుటచేత మధ్యాహ్నకాలమందు గూడ ఎండ తీక్ష్ణముగా లేక సంధ్యాకాలపు వెలుగువలె శాంతముగానుండును.

(*c*) ఇప్పుడు గాలివానకొట్టి జలప్రవాహముచేత రస్తాలలోనున్న చెట్లు పడి గులకరాతిబాట పెక్కుచోట్లను కోసికొనిపోయి యంతయు గుంటమిట్టలుగా చెడిపోయెను. అక్కడక్కడ నిసుక చేరియున్నది కాబట్టి మొట్టమొదట ఇటిక ముక్కలును

నూరు బండ్లు గులకఱాళ్లను తెప్పించినమీదటనే దురస్తుపని యారంభింపవలెను. కొన్ని తావులలో బిఱును బంకమట్టిపఱచి గులకఱాయివేసి దిమ్మిస చేయవలసియున్నది. బాటప్రక్కనసుండు కాలువకట్టమీద గరికివేయవలసియున్నది. ఆ బాటలో బండ్లు ఎప్పుడును వచ్చుపోవుచు ఉండును గనుక త్వరలో దానిని మరమ్మతుచేసి సమముచేయించవలసినది. దిమ్మిసకొయ్యలు గడ్డపార కొయ్యగూటము మొదలగు పనిముట్లును ఒంటిచక్రపు బండ్లను గిడ్డంగినుండి . ఊరుటెల్లుండిలోపల పంపివేయుమని ఉత్తరువుచేయుదును. **Engineer Class, 1st Division.**

MECHANICS. *Time*—3 hours.

Engineer Class, 2nd Division.

1. Prove that the angular velocity of a moving particle, expressed in radians per second, is equal to the component of its linear velocity perpendicular to the radius vector from the given particle, divided by the length of the radius vector.

A particle moves in a circle with constant linear velocity; find its angular velocity at any instant about any given point in the plane of the circle.

2. Find the velocity and potential energy of a body executing a simple harmonic motion, at any point of its range.

Find the resultant of three simple harmonic motions in the same straight line, of the same period and amplitude, and with phases differing by one-third of a period.

3. Prove that when a rigid plane figure is displaced anyhow in its own plane, the displacement is equivalent to a rotation about an axis perpendicular to the plane.

C_1 is the axis, and T_1 the connected point of the beam of a steam-engine, $T_1 T_2$ the crank-rod, T_2 the centre of the crank-pin, and C_2 the axis of the crank and its shaft. Determine the relation between the angular velocities of $C_1 T_1$ and $C_2 T_2$ in any position.

4. Define moment of inertia.

Explain how the moment of inertia of a body about a given axis may be determined by experiment.

Calculate the moment of inertia of a triangular lamina ABC, the angle C being a right angle, about an axis perpendicular to its plane and passing through A.

5. Define centre of percussion.

Determine the impulsive pressure on the axis when a ballistic pendulum receives an impulse.

6. It is proposed to make a cycle track at the People's Park, consisting of two semi-circular curves of 225 feet radius joined by straights. If the width of the track on the curves is 24 feet, what should be the super-elevation of the outer edge in order to counteract the centrifugal force due to a speed of 20 miles per hour?

7. Define the system of forces called a couple. What is the arm of a couple, the axis of a couple, and the moment of a couple?

Find the moment of the horizontal couple of a bifilar suspension consisting of a bar weighing 102·5 gm., suspended by two parallel threads 56 cm. long and 1·5 cm. apart, for a deviation of the bar of 1°.

8. Define centre of gravity.

Engineer Class, 2nd Division.

Find the centre of gravity of the surface of a sphere cut off between two parallel planes.

9. Enunciate Hooke's Law.

A wire of length l and radius r is fixed at one end and the other end is twisted through an angle ψ. Prove that, if M is the moment of the couple which is applied at the free end to produce the twist and n is the coefficient of rigidity, $M = n \pi r^4 \psi/2l$.

ALGEBRAIC GEOMETRY AND HYDROMECHANICS. *Time*—3 hours.

1. Find the co-ordinates of the point which divides the line joining the points (x_1, y_1), (x_2, y_2) in the ratio $m : n$.

Find the co-ordinates of the intersection of the medians of the triangle (x_1, y_1), (x_2, y_2), (x_3, y_3); and show that your investigation affords a proof of the existence of this point.

2. Show that the equation of every straight line may be put into the form $x \cos a + y \sin a - p = 0$.

Find the lengths of the perpendiculars from $(1, -1)$ on the two straight lines $3x + 2y = 0$, $3x + 5y - 1 = 0$.

Find the equation of the locus of a point which moves so that the perpendicular from it on the first of these straight lines is always double the perpendicular on the latter, and state what you infer from your equation as to the nature of the locus.

3. Find the equations of the transverse common tangents to two circles whose centres are $(a, 0)$, $(a', 0)$ and whose radii are r and r'.

Two circles of radii r and s touch the axes of x and y respectively and also touch each other; find the co-ordinates of their point of contact in terms of r, s, and θ, the inclination of the line joining their centre to the axis of x.

4. Find the equation of a parabola when the co-ordinate axes are the directrix and the axis.

If the tangent to the parabola at P meet the directrix in Q, find the equation of the locus of the middle point of PQ, and roughly trace the locus.

5. Prove that in a fluid at rest the pressure at a point is the same in all directions.

Find the magnitude and line of action of the resultant pressure on a flood-gate, the height of the water being greater on one side than on the other.

6. Find the specific gravity of a combination of substances, the weights and specific gravities of which are given, when the volume of the whole is less than the sum of the volumes of the parts in the ratio of $r : 1$.

A bottle full of water weighs 50 grams, and when some pieces of iron weighing 12·2 grams in air are introduced into it and it is again filled up with water, the combined weight is 60·64 grams. What is the specific gravity of iron?

7. What is Archimedes' principle? How may it be experimentally verified?

Engineer Class, 2nd Division.

A uniform rod, the specific gravity of which is ·25, floats in water in a position inclined to the vertical, with a particle of the same weight as the rod attached to its lower end. Find how much of the rod is immersed.

8. Describe a form of barometer in which no liquid is employed.

Taking the mass of 1 c.c. of air as ·001293 gm. and the mass of 1 c.c. of mercury as 13·596 gm., find the height of the homogeneous atmosphere if the barometer stands at 29·981 inches.

GEOLOGY AND HEAT. *Time*—3 hours.

1. Describe the action of rain as an agent of denudation, chemical and physical.

2. Describe Magnetic Iron Ore, Quartzite, Serpentine, and Magnesian Limestone.

3. Classify the chief types of igneous rocks, and explain how they are distinguished.

4. Give an account of the various ways in which lakes and lake-basins have originated.

5. How do sea-waves act in modifying the coastal features of country? Illustrate your answer by examples.

6. Explain what is meant by temperature. Describe any apparatus used for determining the highest and the lowest temperatures reached during any given period.

7. Describe a method of determining directly the coefficient of absolute expansion of a liquid.

For mercury Regnault obtained the following results:—

Temperature.	Volume.
0° C.	1
100° C.	1·01815
300° C.	1·05597

Using the formula $a + bt$ for the coefficient of expansion, calculate the values of the constants a and b for mercury.

8. Explain how the specific heat of a substance may be determined by the method of cooling, and discuss the advantages and disadvantages of the method.

9. State Prevost's Theory of Exchanges and explain the arguments upon which it is based.

A calorimeter is hung up within an outer vessel and it is desired to keep it as far as possible from losing or gaining heat. Discuss the advantages, if any, of silver-plating (*a*) the outside of the calorimeter, (*b*) the inside of the outer vessel.

10. What is meant by the mechanical equivalent of heat?

Explain how the mechanical equivalent of heat may be calculated from a knowledge of the specific heats of air at constant pressure and constant volume. Note any assumptions made in the calculation and state how they may be justified.

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BUILDING AND BRIDGE CONSTRUCTION. *Time*—3 hours.

1. Give sketches showing two courses of coursed rubble masonry suitable for the abutments of a culvert about 3 feet wide.

2. Make cross section sketches of the abutments of a 6-feet arch culvert 3 feet thick, showing the design of the foundations in the following cases:—
   (*a*) Level rock.
   (*b*) Rock with a slope of about 3 : 1.
   (*c*) Black cotton soil.
   (*d*) Sandy clay not liable to scour.

3. Give sketches showing the construction of timbering suitable for a trench in treacherous soil 15 feet deep and 6 feet wide. Name and dimension all parts.

4. What tools and plant would be required for a gang of rivetters composed of 6 men and 2 boys.

5. How would you erect the following spans of girders:—
   (*a*) 20 feet girders lying at bridge site on top of the embankment.
   (*b*) 60 feet girders lying in nullah bed; piers 25 feet high.
   (*c*) 150 feet girders rivetted up on suitable staging at the edge of a deep tidal river.
   What plant would you require in each case?

6. Describe a "ringing" pile driver. What other methods are employed for driving piles?

7. Show by sketch how you would build an ordinary house wall of concrete.

8. What are the various methods of carrying a railway across a girder bridge of, say, 100 feet span?

ROAD AND RAILWAY CONSTRUCTION. *Time*—3 hours.

1. Make a neat sketch of an ordinary double line junction. Show the position of all signals necessary for working it. Number each signal and show what signals should be lowered for a train travelling on each of the four lines of rail. Also show in each case what signals and points should be locked so that they could not be lowered or moved. Show also proper position for the signal box.

2. Explain briefly the principle of the action of the automatic vacuum brake. Supposing a train fitted with this brake breaks into two portions, what will happen to each portion.

3. Make a sketch of a double line roadside station with shunt lines off each main line, two cross-overs and a goods shed. Show the minimum accommodation you would provide for the station-house; also the proper signals.

4. Illustrate by sketch the principle of the bogie vehicle. What are the advantages and disadvantages of this type?

5. A station on a mixed gauge (5′ 6″ and metre) double line has two platforms, one on each side. The outer rail of each main line is

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common to both gauges. Show by neat sketches a mixed gauge cross-over road. All points to be shown half open (foul). Also show all check rails. A single line to represent a rail, but it must not be continued across a flange way in a crossing.

6. Show by a sketch how iron point rodding is compensated for temperature.

7. What kind of locomotives would you adopt for working a line with gradients of 1 in 8. Give sketches of the permanent-way required. On what kinds of work would you employ the following varieties of locomotives:—

(*a*) 4 feet diameter 6 wheel coupled.
(*b*) 8 feet diameter single.
(*c*) 4 wheel coupled tank.

8. How would you erect profiles on sidelong ground. What would be the proper dimensions for a profile on ground sloping 1 vertical in 5 horizontal, section height at centre line height 20 feet, formation 30 feet, slopes 1½ to 1, supposing the soil to be moorum?

9. Give a sketch of a causeway suitable for carrying a first-class road across a piece of country liable to floods.

LEVELLING. *Time*—3 hours.

1. Complete the following page from a level book:—

Back.	Inter.	Fore.	Distance.	Remarks.
8·45			0	
	3·48		48	
	9·51		63	
	0·35		74	
	1·02		100	
	3·84		136	
	6 55		200	
	5·22		238	
	5·66			B.M. 22·50.
	6·17		300	
	8·33		327	
	7·40		400	
11·85		2·15	500	
9·75		2·48	530	
	0·52		600	
	1·10		644	
	5·90		700	
0·50		11·22	731	
1·70		10·51	772	
	6·95		800	
	8·97		872	
		8·97	950	

2. Plot the longitudinal section of question 1. Scales 100 feet to the inch horizontal and 10 feet to the inch vertical. On it show the formation level for a road graded as follows:—Level from 0 to 450, 1 in 25 up to 650, thence falling 1 in 20. Write down on the section the heights of banks and depths of cutting at each even chain. Formation level at 0 is 25·00.

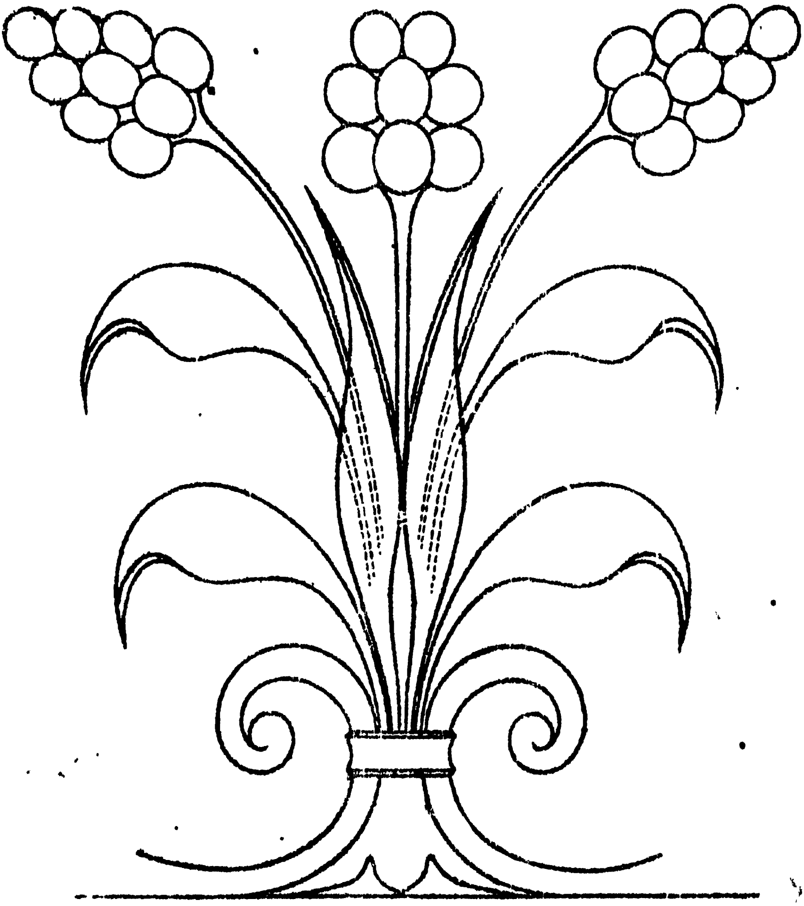
3. Plot the following three cross sections to the scale of 20 feet = 1 inch:—

No. 1 cross section is taken at 000
,, 2 ,, ,, 100
,, 3 ,, ,, 200

Back.	Inter.	Fore.	Remarks.
4·75			150 feet left No. 1.
	5·63		100 ,, ,,
	11·32		Centre peg chainage 000.
	18·50		20 feet right No. 1.
	13·41		70 ,, ,,
	8·43		130 ,, ,,
	7·35		B.M. on rock 93·75.
	5·10		120 feet right No. 2.
13·22		0·21	
	0·00		173 ,, left ,,
	11·10		121 ,, ,, ,,
0·13		13·22	
	11·25		17 ,, ,, ,,
	5·20		0 centre peg chainage 100 feet.
	5·20		21 feet right No. 2.
	0·00		50 ,, ,,
	8·21		50 feet left No. 3.
	15·50		40 ,, ,,
	5·40		20 ,, ,,
	4·43		Centre peg chainage 200 feet.
13·75		0·10	
	2·20		27 feet left No. 3.
13·81		0·10	
	0·15		30 feet right No. 3.
	10·50		45 ,, ,,
	5·65		100 ,, ,,

4. Calculate the amount of earthwork in the above two chains. Formation level being 133·00 at 000 with a falling grade of 1 in 33·33, width of formation 20 feet, slopes 2 to 1.

5. What correction for curvature and refraction would you allow in a sight 1,000 feet long?



Building Drawing (Buildings). *Time*—4 hours.

Engineer Class, 2nd Division.

1. Draw the ½ outside and ½ inside elevations and horizontal and vertical sections of a window opening, 4′ 6″ × 2′ 3″, in a wall, 1½ bricks thick, built in English bond. The reveal to be covered by a gauged arch, 12 inches deep, and the jamb by a lintel 3 inches thick, and a relieving arch in two rings. The sill stone to be 2′ 7½″ × 6″ × 11″. Bricks 9″ × 4½″ × 3″. Scale ½ inch to one foot. Show two feet of wall all round opening.

2. Make detailed drawings of a venetian window suitable for the opening in question 1. The scantling of the frame to be 4″ × 3½″ properly framed and morticed, rebated ½ inch wide to the full thickness of the shutter and to have a return bead moulded on the other side. The shutter to be of two equal panels filled with venetians. Stiles and rails to be 3″ × 1¼″. Venetian blades 3½ inches wide and ⅜ inch thick and to overlap about half their width. The ends of blades to be rounded off at centre to ⅜ inch diameter and ¾ inch long and round holes to be made in the sides of the rebate in the frame to receive them. The venetian blades to be attached to stanchions ¾″ × ½″.

The drawings required are (1) outside and inside elevations and vertical section through venetians to a scale $\frac{1}{12}$; (2) section through venetians showing rebate in side of frame and a plan of a venetian blade to a scale ⅛.

3. If you have time ink in and colour your drawings.

Freehand, Model and Perspective Drawing. *Time*—3 hours.

1. Copy the drawings on the accompanying sheet to ¾ scale.

2. Make fully dimensioned hand sketches of the model placed before you such that detailed drawings could be made from your sketches if necessary.

3. Draw in perspective to a scale ½ inch = 1 foot the solid of which an elevation and plan are given. The angle *A* must touch the picture plane at a point one foot to the right of the spectator, the side *AB* making an angle of 60° with the picture plane, inclining from it to the right. Height of eye 5 feet, distance 7 feet.

Arithmetic and Algebra. *Time*—3 hours.

Engineer Class, 3rd Division.

1. Give the sum of each of the following columns without copying them out:—

	cd.	md.	v.	plm.
8008870	914	17	6	26
4959564	984	1	4	18
1900259	63	6	7	1
884095	123	0	3	33
5791648	9	15	5	25
27323	62	9	2	7
9673038	331	3	6	19

	cd.	md.	v.	plm.
6623	409	17	0	11
4376506	47	1	4	2
13172	539	15	5	34
824789	6	9	2	15
5178587	78	3	6	27
9049	747	16	3	28
5970666	817	9	7	9

2. Find to the nearest pie the value of ·3276 of Rs. 26–9–5.

3. Find the lowest common multiple of $38\frac{1}{4}$, $59\frac{1}{2}$, and $63\frac{3}{4}$.

4. A shopkeeper's debts are Rs. 7,523–13–5, and his assets are Rs. 2,693–5–8; how much can he pay in the rupee, and how much does a creditor for Rs. 423–7–4 receive?

5. A man leaves his property, worth a lakh of rupees, to be divided between his two sons so that each may have the same amount on attaining the age of 21 years. If his sons are aged respectively 15 and 18 years at the date of his death, what sum ought his executors to set apart for each, compound interest being reckoned at 4 per cent. per annum?

6. Two clocks indicated the correct time at noon on the first of December. One gains 6 seconds and the other loses 2 seconds a day. When will one be half an hour ahead of the other, and what time will it then show?

7. Establish the following formulæ—

$$\frac{a}{b} \pm \frac{c}{d} = \frac{ad \pm bc}{bd};$$

$$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m} \text{ (} m \text{ being a positive integer).}$$

Simplify—

$$\frac{\left\{x^{a-b} \times x^{b-c}\right\} \times \left(\frac{x^a}{x^c}\right)^c}{\left(x^a \times x^c\right)^a \div \left(x^{a+c}\right)^c}.$$

8. Solve the equations—

$$\frac{x^2}{p} + \frac{x}{p^2} + \frac{1}{p^3} = \frac{p}{x^2} + \frac{p^2}{x} + p^3.$$

$$a^2(y+z)^2 = a^2x^2 + 1,$$
$$b^2(z+x)^2 = b^2y^2 + 1,$$
$$c^2(x+y)^2 = c^2z^2 + 1.$$

9. Find the number of permutations of n things taken in groups of r.

Find the number when any one thing may occur once, twice, thrice, . . . up to r times in each group.

Find the sum of all the integral numbers which have not more than three digits.

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10. Expand $\dfrac{1-3x+7x^2-8x^3+4x^4}{(1-x)^2(1+x^3)}$ as a sum of partial fractions.

11. Sum the series—
(1) $2r^2+4r^4+6r^6+\ldots\ldots+2nr^{2n}$,
(2) $(x+1)(x-1)+(x^2+2)(x^2-2)+\ldots\ldots\ldots+(x^n+n)(x^n-n)$.

GEOMETRY (EUCLID) AND MENSURATION. *Time*—3 hours.

1. Prove that equal triangles on the same side of the same base are between the same parallels.

Find the locus of the middle points of straight lines drawn from a given point to the circumference of a given circle.

2. Find a point C in a given straight line AB such that $AC^2 = AB.BC$.

If C is a point in AB such that $AC^2 = AB.BC$, and C' a point in BA produced such that $AC'^2 = AB.BC'$, and if O bisects CC', show that $OA^2 + OC^2 = OB.BA$.

3. Show that the angle subtended at the circumference of a circle by any arc of the circle is half the angle subtended by the same arc at the centre.

A and B are fixed points on a given circle and P a movable point on it. PA and PB are produced to C and D so that $PA = AC$ and $PB = BD$. Find the locus of the middle point of CD.

4. About a given circle circumscribe a triangle equiangular to a given triangle.

AB is an arc of a circle less than a semicircle and P is any point in the arc. Prove that the angle APB exceeds half the angle between the tangents at A and B by a right angle.

5. Prove that the areas of similar rectilinear figures are to one another in the duplicate ratio of the homologous sides of the figures.

The side BC of a triangle ABC is produced to a point D such that the triangle BAD is to the triangle ACD in the duplicate ratio of BA to AC. Prove that AD is a mean proportional between BD and CD.

6. Prove that every plane passing through a perpendicular to a plane is also perpendicular to that plane, and conversely.

If the perpendiculars from A and B on the opposite faces of a tetrahedron $ABCD$ intersect, show that the squares on AC and BD are equal to the squares on BC and AD.

7. On a certain map a square inch represents 4,000 acres. What is the linear scale?

8. Find how much water would be required to fill an elliptical basin 170 feet × 73 feet, half of it being 4 feet deep and the other half 6 feet deep. (One gallon occupies 277·274 cubic inches.)

9. The vertical angle of a cone is a right angle and the length of its slant side 1 foot. Calculate its whole surface to the nearest square inch.

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TRIGONOMETRY AND GEOMETRY (CONICS). *Time*—3 hours.

1. Define the radian, show that it is a constant angle, and calculate the number of degrees and minutes in it. ($\pi = 3{\cdot}1416$.)

2. Prove by means of a geometrical diagram that $\tan(\pi + \theta) = \tan\theta$ for all values of θ.

Find a general formula for all the angles whose tangent is $\sqrt{3}$, and evaluate $\tan(3n + 1)\frac{\pi}{4}$.

Solve the equation $3\tan^2\theta - 4\sqrt{3}\sec\theta + 7 = 0$.

3. Assuming the formulæ for the expansion of $\sin(A \pm B)$ and $\cos(A \pm B)$, express $\sin(A + B - C)$ and $\sin 3A$ in terms of trigonometrical functions of the single angles, A, B, and C; and show that $\sin 2A = 2\tan A/(1 + \tan^2 A)$.

Show that $\dfrac{\tan 2\theta + \sec 2\theta + 1}{\tan 2\theta + \sec 2\theta - 1} = \cot\theta$.

Solve the equation—

$$\sin n\theta - \sin(n-1)\theta = \cos n\theta - \cos(n-1)\theta.$$

4. Show that in any triangle ABC $a = b\cos C + c\cos B$, and by means of this and the two similar equations show that

$$\cos^2 A + \cos^2 B + \cos^2 C + 2\cos A\cos B\cos C = 1.$$

Show that—

$$\frac{b\sin B - c\sin C}{b\cos B + c\cos C} + \frac{c\sin C - a\sin A}{c\cos C + a\cos A} + \frac{a\sin A - b\sin B}{a\cos A + b\cos B}$$

$= \tan) B - C) \tan(C - A)\tan(A - B)$.

5. Write down the trigonometrical formulæ for solving a triangle when a, B, C are given.

Calculate the distance of the orthocentre of a triangle from the side BC in terms of a, B, and C.

6. A base line AB 432·8 yards long is measured in the same vertical plane as the summit H of a mountain (B being nearest the mountain). At A the angular elevation of H is $34^\circ\ 29'\ 18''$ and the angular depression of B, $6^\circ\ 12'\ 13''$; and at B the angular elevation of H is $50^\circ\ 9'\ 27''$. Find the height of the mountain above A.

7. Prove that if from the point of contact Q of a tangent to a parabola a chord QQ' be drawn, and if any line parallel to the axis be drawn meeting the tangent at S, the parabola at R, and the chord at I, then $SR : RI :: QI : IQ'$.

Hence, or otherwise, show that if F is the focus and P the point of contact of the tangent parallel to QQ', then $QI^2 = 4\,FP.SR$.

8. Prove that the tangent at any point of an ellipse makes equal angles with the focal distances of the point.

Y is the foot of the perpendicular from the focus F of an ellipse on the tangent at P, and FY is produced to H so that $FY = YH$. Find the loci of Y and H.

9. Prove that if PN is the ordinate of any point P on a rectangular hyperbola whose vertices are A and A', then $PN^2 = AN.A'N$.

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BUILDING MATERIALS. *Time*—3 hours.

1. What are the characteristics of good building stones and into what classes are they divided? Describe and classify:—Granite, laterite, kunkar, flint, and state for what purposes they are most useful.

2. Describe the process of brick-making at the Government brick-fields, Madras, with four sketches and a detailed description of the Hoffman's kiln. What are the advantages and disadvantages of this kiln?

3. What is the object of glazing bricks and tiles and how is a transparent glaze effected.

4. How are limes classed? Describe the process of slaking and state the precautions which should be observed. Why cannot a fat lime set or harden in damp places?

5. To what forms of decay is timber specially liable and how can they be retarded?

6. When is iron said to be "red short" and "cold short" and to what cause are these defects due? How can the defect of "red shortness" be avoided?

7. Sketch with dimensions a treble riveted lap joint. Plates ½ inch thick and rivets ¼ inch diameter. Give also a fully dimensioned sketch of a rivet before and after clenching.

8. What is the usual basis of an oil paint and what is the object of each constituent. Describe the process of painting on plaster.

GEOMETRICAL DRAWING. *Time*—3 hours.

1. Draw an equilateral triangle of 2 inches side and four circles, each touching one side of that triangle and the other two or those two produced.

2. On a line 2 inches long construct an isosceles triangle with a vertical angle of 50°, and construct a square of equal area with the triangle.

3. Draw a circle of 3 inches diameter with centre O. The corners of a polygon inscribed in this circle are so placed that the angle at the centre are:—$AOB = 60°$; $BOC = 120°$; $COD = 100°$. Write down the lengths of AB, BC, CD, and DA..

4. Construct the quantity $\sqrt{a^2 + 5b^2}$ when $a = 1$ inch and $b = \frac{1}{2}$ inch without extracting the square root.

5. In a circle, 1·7 inches radius, inscribe three equal circles, each touching the circumscribing circle and the two inscribed circles..

6. Describe a circle, 1½ inches radius, and in it inscribe an equilateral and equiangular pentagon.

7. A pentagonal surface, side one inch, is inclined 40° with the plane of the paper and the line joining two alternate corners of the figure is horizontal; draw the plan and elevation.

8. Determine the plan and elevation of an octohedron of side 1½ inches when it rests with one of its triangular faces upon the paper.

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9. Draw the isometric view of a box, 18″ × 9″ × 6″, with the lid open at an angle of 60°. The box is made of $\frac{1}{2}$ inch deal. Scale $1\frac{1}{2}$ inches to a foot.

NOTE.—Constructions to be strictly geometrical, and particular care to be taken not to efface lines necessary for a correct solution. Construction lines to be dotted. All lines should be inked if time permits.

CHAIN, COMPASS AND PLANE TABLE SURVEY. *Time*—3 hours.

1. Plot the following compass traverse. Scale 100 feet = 1 inch.

Readings at	Distances.
A $142\frac{3}{4}$	*AB* 816.
B $212\frac{1}{2}$	*BC* 515.
C $167\frac{1}{4}$	*CD* 220.
D $315\frac{1}{2}$	*DE* 724.
E $346\frac{3}{4}$	*EF* 733.
F $119\frac{1}{4}$	*FG* 350.
G 355	*GH* 300.

What is the bearing and length of the closing line *HA* ?

2. Plot the following chain survey. Scale 100 feet =1 inch.

AB 763	*BF* 286.
AD 603	*EF* 296.
BD 555	*FG* 395.
BE 582	*GE* 539.
AE 453	*DG* 960.
DE 790	

3. In question 2 plot the accompanying extracts from the field book.

4. Find the area of the traverse of question No. 1 in acres and decimals.

5. How would you chain down a very irregular and steep slope?

6. Supposing the length of your chain is found to be 100·27 feet, what is the true length of a line which has been measured 1,573 feet?

7. How would you, by the aid of flags only, find a point in line between two inaccessible marks?

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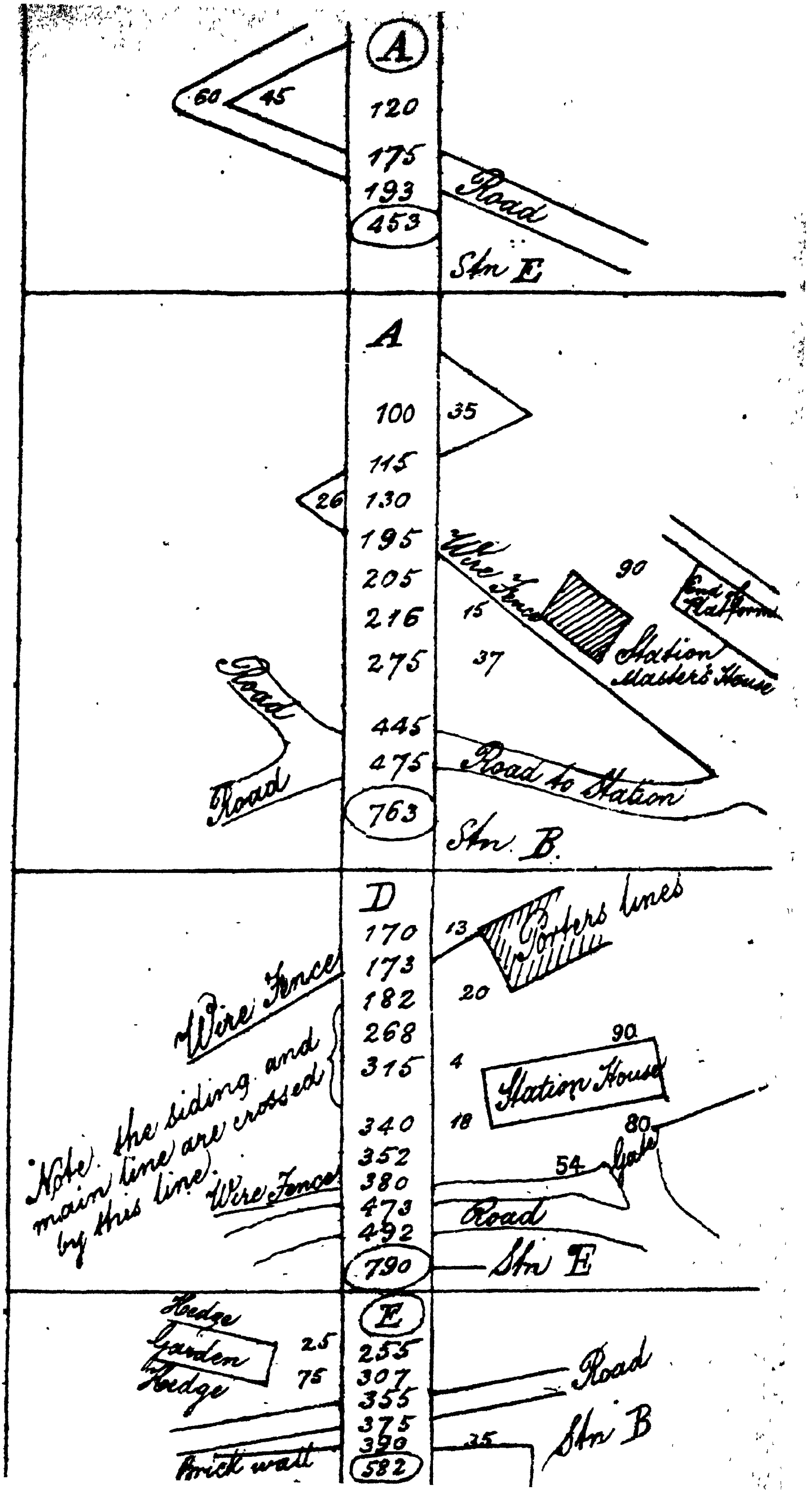
TRIGONOMETRY AND STATICS. *Time*—3 hours.

1. Prove for all values of θ that $\sin^2\theta + \cos^2\theta = 1$.
Show that—
$$2(\sin^6\theta + \cos^6\theta) = 3(\sin^4\theta + \cos^4\theta) - 1.$$

2. Prove geometrically that $\cos(180° - A) = -\cos A$.
Find the values of sin 495°, cos 210°, and sec 690°.

3. Assuming the formula $\cos(A+B) = \cos A \cos B - \sin A \sin B$, deduce formulæ for expanding $\cos(A-B)$, $\sin(A+B)$, $\tan(A+B)$, and $\cos 3A$.


A
Road
Stn E
A
Wire Fence
End Platform
Station Master's House
Road
Road to Station
Road
Stn B.
D
Porters lines
Wire Fence
Station House
Note. the siding and main line are crossed by this line
Gate
Wire Fence
Road
Stn E
E
Hedge
Garden
Hedge
Road
Stn B
Brick wall

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Prove that—

$$\frac{\sin A + \sin 3A + \sin 5A + \sin 7A}{\cos A + \cos 3A + \cos 5A + \cos 7A} = \tan 4A,$$

and that

$$\frac{\sin 5A + \sin 7A}{\sin 2A\,(1 + 2\cos 2A)} = 2\cos 3A.$$

4. If $A + B + C = 180^\circ$, prove that—

$$\sin A + \sin B + \sin C = 4\cos\frac{A}{2}\cos\frac{B}{2}\cos\frac{C}{2};$$

and that

$$\frac{\tan A + \tan B + \tan C}{\sin 2A + \sin 2B + \sin 2C} = \tfrac{1}{4}\sec A\sec B\sec C.$$

5. Investigate the usual formulæ adapted for logarithmic computation for the determination of the angles and area of a plane triangle when the three sides are given.

Determine the angles and area of a triangle whose sides are 125, 150 and 170 feet long respectively.

6. Prove that if three forces, acting on a particle, are in equilibrium, they may be represented by the sides of a triangle taken in order.

A mass of 8 lbs. hangs by a chain 17 feet long and is pulled out by a horizontal force to a distance of 15 feet from the vertical through the point of support. Find the tension of the chain.

7. Define the moment of a force about a point.

Prove that if a number of forces act on a body and are in the same plane they will be in equilibrium if the algebraical sum of their moments vanish round any three points in the plane, provided that these three points are not in the same straight line.

Three forces acting on a body are fully represented by the three medians of a triangle. Show that they are in equilibrium.

8. Define Centre of Gravity.

Find the C.G. of a triangular lamina.

A portion of a triangular lamina ABC is cut off by a line DE which bisects the sides AB and AC. Find the C.G. of the part $DBCE$.

9. State the laws of statical friction, and explain how the coefficient of friction between two substances may be determined.

A body of mass m is just supported by friction on a plane inclined at an angle θ to the horizon. Find the magnitude of the least horizontal force which will move it up the plane.

APPLIED MECHANICS. *Time*—3 hours.

1. A rectangular tie bar of wrought iron, 10 feet long 4 inches wide and ½ an inch thick, supports a steady working load of 15 tons. It is proposed to substitute for it a bar of steel of the same dimensions in anticipation of the load being increased; what may be the greatest amount of this increased load in order that the factor of safety relatively

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to the limit of elasticity may be the same as for the iron bar? Assu the following data:—

The strain limit of elasticity of wrought iron = 0·001.
" " " steel = $\frac{1}{600}$.
Coefficient of elasticity of wrought iron = 12,000 tons square inch.
Coefficient of elasticity of steel = 13,000 tons per square in

2. To what height can a chimney (treated as a hollow cylind be safely built, calculating for a wind pressure of 40 lb. per square f on the vertical flat surface directly exposed to it? Weight of bri work 112 lb. per cubic foot; chimney 10 feet external diameter; bri work 12 inches thick; tenacity of mortar to be neglected.

3. Which of two equal bars, one being of wrought iron and t other of cast iron, will stretch the most under the same load within t limits of elasticity?

The coefficient of elasticity for cast iron = 7,500 tons square inch.

4. If a girder with 30 feet clear span is loaded with five conce trated loads thus: 3 tons at 7 feet, 4 tons at 12 feet, 2½ tons at 20 fe 2 tons at 24 feet and 1 ton at 27 feet from the same support. Find t section on which the bending moment is greatest, determine its valu and also the amount of the bending moments and shearing forces 8 feet from each support.

5. The section of an iron beam consists of a vertical middle w with top and bottom flanges. The areas of the flanges may be taken concentrated in their horizontal centre lines. A bending moment 50 feet tons acts on this section. Assuming the web to be 12 inch deep and that its sectional area is equal to the joint sectional areas the two flanges, determine the sectional area of each flange in ord that the greatest intensity of stress shall be 5 tons per square inch.

6. An isosceles triangular truss carries a concentrated load 10 tons at its vertex. The truss consists of two rafters inclined at 3 and a horizontal tie. Find the stress on the rafters and tie.

NOTE.—(1) Questions 2, 4, 6 may be solved either graphically mathematically, but more marks will be allotted for the former metho

(2) The meaning of all symbols in any formula used mu be clearly defined.

MECHANISM AND THE STEAM ENGINE. *Time*—3 hours.

1. I want to drive the shaft *A* at a speed of 100 revolutio per minute from the fly wheel *B* of the stationary engine shown in t accompanying sketch. What is the best way to do this. Sketch in t arrangement you would purpose giving details of any auxiliary shaf pullies or other gearing necessary.

2. A Haley's jack arranged as shown in the accompanying sket is required to lift 3 tons. What pressure must a man exert on t handle *A*.

3. In a railway wagon wheel lathe the slide rest screw is threads to the inch. It is fed by a ratchet working in a ratchet whe

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on the end of the screw. This ratchet wheel has 40 teeth and the ratchet takes 3 teeth at each revolution of the lathe. How long will it take to turn up a wagon wheel 3′ 8″ diameter and 5 inches broad allowing a cutting speed of 20 feet per minute.

4. A stationary engine with a fly wheel 9′ 0″ diameter is driving a main shaft by a Gandy cotton belt 14″ wide. The engine is running at 75 revolutions per minute. What power is the belt capable of transmitting?

5. Make a hand sketch of a pair of gauge column cocks suitable for a stationary boiler and explain if you can the principle involved in their use.

6. Make a sketch of an ordinary double flued Lancashire boiler showing the way in which the boiler should be set in the brickwork with details of all flues.

7. What is a beam engine and in what way does it differ from a horizontal engine. For what purposes are beam engines generally suitable and why. Illustrate your answer by a sketch if possible and give any information you may be able to furnish on the point.

HYDRAULICS AND IRRIGATION WORKS. *Time*—4 hours.

1. Define the terms—"coefficient of velocity," "coefficient of discharge," "coefficient of contraction" and state their relation to each other. What is meant by "velocity of approach," "hydraulic gradient," "hydraulic mean radius"?

2. The catchment area of a tank is 25 square miles, of which 16 square miles is free. Assuming that the maximum recorded rainfall in 12 hours is 10 inches and that the whole of the quantity which falls on a standard area of 5 square miles passes to the point of discharge, calculate, by Ryves' formula, the maximum flood discharge. Can you uggest any way of practically determining the discharge from a atchment area?

3. The tank in question 2 has three escapes. Determine what ngth of the crest of escape No. 2 should be cut down to *FTL* in rder to reduce *MWL* to 2 feet above *FTL*.

Escape No. 1 has 40 vents each 4 feet high and 3 feet wide ith sills 4 feet below *FTL*. The platform is at *MWL* and water n rear 2 feet below *FTL*. ($C = \frac{5}{8}$.)

Escape No. 2 is a free overfall weir 200 feet long with crest t *FTL* + 6 inches. ($C = \frac{5}{8}$.)

Escape No. 3 is a flat pavement 50 feet long (rough stone alingulah) packed at 2 feet below *FTL* with 20 dam stones, each 6 nches wide and 2 feet high, inserted at regular intervals. ($C = \frac{5}{12}$.)

4. A sluice irrigates 5,000 acres. Determine the duty of water from the following data:—Sill + 10·00; top of vent + 13·00; water evel in front + 15·00; water level in rear + 13·00; width of vent 2½ feet. ($C = \frac{5}{8}$.)

5. Describe the object and construction of a canal lock. What governs the position of the sluices?

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A lock 150′ × 20′ with a lift of 9 feet is filled by two sluices each 3 feet square with sills 6 feet below water level in the upper reach, and emptied by two sluices 2 feet square whose centres are 3 feet below water level in the lower reach. How long will it take to fill and empty the lock? ($C = \frac{5}{8}$.)

6. A tank has a capacity of 20 millions cubic feet and is fed from a river with an intermittent supply. Experience shows that freshes in the river can only be expected for eight days during the year and that the depth of water during the freshes will ordinarily not exceed 3 feet. The supply channel has a fall $\frac{1}{5000}$ and side slopes 1½ to 1. What should be the bottom width. ($C = 72$.)

7. An irrigation channel is passed under a drain by means of an under-tunnel. The waterway of the under-tunnel is 3 feet wide and 4 feet high and water level in front and rear is 10 feet and 9 feet above floor. The side walls are of masonry 2½ feet thick and the roof is formed of granite stones 5 feet long and 9 inches thick overlaid with 1½ feet of concrete. Show by calculation whether the building can withstand the water pressure. Weight of masonry 125 lb., of concrete 140 lb., and of stone 170 lb. per cubic foot. Tenacity of mortar to be neglected.

8. The water-supply of a town is derived from a reservoir in which water stands 30 feet above the centre of the inlet end of the pipe. The water main is 2 miles long and 18 inches diameter and is laid at a slope of 50 feet per mile. If the allowance of water for each inhabitant is 60 gallons per day, of which two-thirds must be delivered in eight hours, what population can be supplied? Water to be delivered 50 feet above the end of the main. ($C = 78$; one cubic foot $= 6{\cdot}23$ gallons.)

If the end of the main is stopped by a plug what will be the pressure in lbs. per square inch?

TOPOGRAPHICAL DRAWING. *Time*—3 hours.

1. On the paper which you use for the sketch in question 3 print the following heading. The words to be suitably arranged and the letters of suitable form and size. The scale to be drawn and its representative fraction given.

Topographical sketch. Scale $\frac{1}{\qquad}$

2. A drawing has no scale attached but a line on it, which m sures 3½ inches, is figured 11½ feet. Make a scale for the drawing an construct a corresponding scale of metres. (One metre = 3·28 feet. Write down the representative fraction.

3. A canal, which runs parallel to the coast about ½ mile from t sea, crosses a backwater which at the point of crossing is 6 furlon wide. The backwater extends inland beyond the limits of the sket and at the bar narrows down to a width of 330 feet. On the so margin of the backwater is a large village and a road, which termin at a house near the bar, and, on the beach, ¼ mile south of th is a small fishing village. The road has an avenue of tamarind

of the outlying houses of the village are surrounded by cocoanut The coast north and south of the bar between the sea and the is planted with casuarina trees. To the north of the backwater est of the canal are salt pans 1½ acres in area and some wet culon. Make a sketch of the country thus described showing ½ mile al on each side of the backwater. Scale 8 inches to a mile.

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. Show half a square mile of hilly country (1) by contours, (2) by ng. Scale 12 inches to a mile.

MACHINE DRAWING. *Time*—4 hours.

. Draw to scale half size plan elevation and sections of the screw jack shown in the accompanying hand sketch.

. A shaft 2′ 0″ long 3″ diameter has a neck or bearing 4″ long ″ diameter turned in it 8″ from one end, 6 inches from the bearing k key is let into the shaft, the key being 6″ long ¾″ wide ½″ thick 1 in 12. Draw the shaft showing the bearing and the key.

Ink in and colour as much of No. 1 or No. 2 as time will permit.

BUILDING DRAWING (BRIDGES AND IRRIGATION WORKS). *Time*—4 hours.

The drawing represents the half elevation and half longitudiion of a sigle arch 10 feet culvert. From the data given below drawing to a scale $\frac{1}{50}$ of a culvert of 2 spans of 10 feet; giving vation; (2) ½ longitudinal section; (3) ½ plan at top; (4) ½ plan level; (5) section through crown of arch; (6) section of wing

DATA.

Foundation and floor under arch to be of concrete 2½ feet thick foot offset all round.

Superstructure to be of brickwork.

Arch to be semicircular 5 feet radius and 15 inches thick.

Wing walls to be plumb faced and to have a back batter 1 in 4 play of 1 to 1. The slope of the upper surface to be 1½ to 1 to k. The breadth to be 15 inches at top measured on the square height to be equal to height of formation or line of top of bank et

Centre pier to be 2½ feet thick and to have a suitable cut-water pstream end.

Parapets to be as shown and 15 inches thick. To be set out 3 and to have guard stones.

The culvert to be suitable for a road 20 feet wide with side 1½ to 1. The drawings to be fully dimensioned and finished. o be drawn.

Ink in your drawings and print the heading: "Building Drawridges and Irrigation Works);" also the name of each view.

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ESTIMATING. *Time*—4 hours.

Take out fully and in detail the quantity of each description of work (1) in the weir, (2) in the latrine shown on the accompanying drawings; abstract these in estimate form and estimate the cost.

SPECIFICATION FOR WEIR.

Foundations.—To be of concrete as shown.

Superstructure.—To be brick in chunam pointed.

RATES FOR WEIR.

Concrete Rs. 10 per 100 c. ft.; brickwork Rs. 20 per 100 c. ft.; pointing Rs. 1–8–0 per square.

SPECIFICATION FOR LATRINE.

Foundations.—To be of concrete as shown.

Superstructure.—To be brickwork in chunam.

Woodwork.—To be Burma teak.

Door.—A 2″ framed and battened door to be provided. The for uprights of frame to be of stone.

Roof.—To be single tiled (battens 3″ × 2″; ridge batt wall plates 4″ × 3″).

Floor.—To be of rammed clay 8″ thick.

Interior and exterior fittings.—The interior to be colour-washed, exterior pointed. The seat to be of teak-wood resting on a slab of dressed stone. All wood work to be painted two coats.

Plinth protection.—To be of rammed kunkar of an average t ness 5¼ inches.

RATES FOR LATRINE.

Earthwork Rs. 3–8–0 per 1,000 c. ft.; concrete Rs. 16 per c. ft.; rammed kunkar Rs. 2–8–0 per 100 c. ft.; rammed clay per 100 c. ft.; brickwork (including archwork and pointing) Rs. 25 p 100 c. ft.; cornices As. 4 per running foot; dressed stone Re. 1 pe c. ft.; colour-washing As. 4 per square; single tiling Rs. 8 per square; joinery Rs. 1–8–0 per sq. ft.; timber framed and fixed Rs. 3–8–0 per c. ft.; painting Rs. 4 per square.

THEODOLITE SURVEY. *Time*—3 hours.

1. Practical question. Permanent adjustment of theodolite.

2. Construct a Vernier scale to read to minutes. Show the scale reading 5° 17′.

3. A siding takes off a main line of railway (which is straight) with a curve of 600 feet radius and 250 feet long. The siding thence to the end is straight, distance half a mile. How far will the end of the siding be from the nearest point of the main line?

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4. How would you set out a curve when the country is more or less level except that the two tangent points are situated at the bottom of deep watercourses?

5. The intersection points of two straights fall in the middle of a village. A subsidiary intersection point is therefore selected in each straight and the angles between the straight and the other subsidiary point read at each of these points are respectively 150° 03′ and 160° 59′. The distance between the subsidiary points being 1,500 feet, what will be the distance from each of these points to the tangent points of a curve of 3,820 feet radius?

6. (*a*) In the triangle CAD of a trigonometrical survey, the side
$AC = 458{\cdot}656$ feet;
$AD = 484{\cdot}725$ feet;
and the angle $A = 114^\circ\, 23'\, 28''$.
What is the length of the third side?

7. In question No. 6 if the reduced level of station A is 275·467 feet and the altitude of station C is $-\,0^\circ\, 30'\, 12\frac{1}{4}''$, what will be the reduced level of C? Height of instrument being 4·625 feet; height of signal 7·125.

TAMIL AND TELUGU. Same paper as for Engineer Class, 1st Division.
Time—3 hours.

EUCLID AND MENSURATION. *Time*—3 hours.

Engineer Subordinate Class, 2nd Division.

1. Prove that triangles on equal bases and between the same parallels are equal in area.

From the sides of the triangle ABC, AA', BB', and CC' are cut off each equal to two-thirds of the side from which it is cut. Show that the triangle $A'B'C'$ is one-third of the triangle ABC.

2. Prove that if a straight line be divided into two equal segments and also internally into two unequal segments, the sum of the squares on the two unequal segments is double the sum of the squares on half the line and on the line between the points of section.

Prove that twice the square on the line joining any point in the hypotenuse of a right-angled isosceles triangle to the vertex is equal to the sum of the squares on the segments of the hypotenuse.

3. Prove that the line joining the centre of a circle to the middle point of a chord is perpendicular to the chord. Find the locus of the middle points of a series of parallel chords.

4. Show that the angles between any tangent and a chord through its point of contact are equal to the angles in the alternate segments into which the chord divides the circle.

If t and t' be the lengths of the direct and transverse common tangents to two circles of diameters d and d', show that $t^2 - t'^2 = dd'$.

5. About a given circle circumscribe a triangle equiangular to a given triangle.

A triangle is inscribed in one circle and circumscribes another. Show that the triangle formed by joining the points of contact of the sides of the given triangle with the inner circle is equiangular with the triangle formed by joining the middle points of the arcs of the outer circle.

6. A rupee and an eight-anna piece have diameters of $1\frac{1}{5}$ of an inch and $\frac{19}{20}$ of an inch respectively. If an eight-anna piece lie wholly on the top of a rupee, how much of the upper surface of the rupee will be left uncovered?

7. A circular plate of lead 3 inches in thickness and 12 inches in diameter is converted without loss into spherical shot of the same density and each of ·05 inch radius. How many shot does it make?

8. Find the number of cubic feet in a piece of timber which is 30 feet long and tapers regularly, one end being a circle 6 feet 5 inches in circumference and the other a circle 4 feet 7 inches in circumference.

BUILDING AND BRIDGE CONSTRUCTION. *Time*—3 hours.

1. Define the following terms:—(*a*) Plinth, (*b*) Skew backs, (*c*) Spandril, (*d*) Intrados, (*e*) Purlin.

2. Make sketches of a temporary crib work bridge suitable for a diversion of a metre gauge railway line, bank 6 feet high.

3. How would you hoist a 40-feet girder span? Show clearly by sketches the arrangements and write down what plant you would require. What rivetting would you do before and after the hoisting? Height of abutments, about 20 feet.

4. Give fully dimensioned sketches showing the details of wooden centring suitable for a 6-feet semicircular arch culvert. Show clearly how the centres are struck.

5. How would you sink a well foundation for a bridge-pier? Give a description of the various operations necessary until the pier is ready to receive the girders.

The answer to this question to be as brief as possible.

6. What will be the length of the barrel of the following culvert. Also give a neat sketch showing the foundation plan with all distances, &c., necessary for pegging out the foundation.

Floor level to formation 20 feet; formation 20 feet wide; slopes 2 : 1; floor level to springing of arch 6 feet; span 10 feet; arch segmental $\frac{1}{4}$ rise; arch 1′ 6″ thick; parapets 1 foot above top of arch; splay of wings 1 in 4; return walls 3 feet above floor; thickness of abutment at top of footings 4′ 6″; two courses of footings on the face each projecting 6 inches; wings and returns 2′ 2″ wide at top; face batter 1 in 6; floor level same as top of footings; there is concrete throughout below the masonry projecting 6 inches on each side.

EARTHWORK AND ROADS. *Time*—3 hours.

Engineer Subordinate Class, 2nd Division.

1. How would you drain the slopes of a cutting which, owing to the nature of the soil, was subject to slips? Amplify your answer by sketches.

2. Why is it usually considered necessary to break clods and lumps in throwing up an embankment?

3. The following represents the longitudinal section of a trunk road:—

Ft.	R.L.	Ft.	R.L.
0	100·00	600	97·00
100	98·00	700	92·00
200	92·00	800	85·00
300	97·00	900	90·00
350	99·00	950	98·00
400	105·00	1000	103·00
450	108·00	1100	102·00
500	101·00	1200	96·00

Supposing formation level at 0 is 100·00 and that the ridges are composed of hard rock and the hollows of soft soil, show how you would grade the road, the ruling gradient to be 1 in 40. Scale 100 feet to 1 inch horizontal, 10 feet to 1 inch vertical.

4. In question No. 3, assuming the formation to be 30 feet wide in bank, 35 feet wide in cutting, slopes in bank 2 : 1 in cutting vertical and the road to be level throughout the section at 100·00—

(*a*) Write down the heights of banks and depths of cuttings at each even chain and calculate the amount of earthwork in each chain.

(*b*) Draw the land plans required, allowing a 10-feet cess on each side of toe of slope. Scale 100 feet to 1 inch.

(*c*) Supposing the excavation in the side pits can conveniently only be dug 3 feet deep, show on the land plan the temporary land required for side pits and also for the spoil banks.

5. It is necessary to put on a 3-feet slab covered culvert with 9 feet of waterway under a bank 20 feet high at centre line. The ground surface down-stream is level, but slopes upwards on the up-stream side 1 vertical in 2 horizontal. Show by means of neat sketches the design of culvert you would adopt.

6. What quantity of dynamite would be required to blast 10,000 cubic feet of rock? How many men and what tools would be necessary to complete the work in a month?

BUILDING DRAWING (BUILDINGS). *Time*—4 hours.

1. Make a design for a building 20′ × 10′ with foundations of concrete and walls of brickwork 1½ feet thick. The roof to be a concrete arch 6 inches thick, springing at 10 feet above floor, the thrust being taken by five tie rods ¾ inch diameter. Rise of arch 10 inches. The building to be finished off with a parapet wall all round. A framed and braced door 4′ × 7′ and two batten windows 3′ × 4′ to be provided.

Engineer Subordinate Class, 2nd, Division.

A plan, front elevation, and longitudinal and cross section of building to be drawn to a scale 4 feet to an inch and details of roof and method of fixing tie rods to a scale $1\frac{1}{2}$ feet to an inch.

2. Give inside and outside elevations and horizontal and vertical sections of the door opening in question 1, assuming that the bricks are $9'' \times 4\frac{1}{2}'' \times 3''$ and that English board is used. Details of lintel and relieving arches to be clearly shown. Scale $1\frac{1}{2}$ feet to an inch.

3. Make detailed drawings of double doors to fit the opening in question 1. The doors to consist of vertical boards $\frac{5}{8}''$ thick secured together on a framework of wood. The frame to consist of stiles $4\frac{1}{2}'' \times 1\frac{5}{8}''$, top rail $4\frac{1}{2}'' \times 1\frac{5}{8}''$, centre and bottom rail $7'' \times 1''$, braces $4\frac{1}{2}'' \times 1''$. The boards to be planed and rebated together and fixed flush with the outside of the frame. Each leaf to be hung with iron strap hinges screwed to the rails. The door frame, post and head to be $5'' \times 4''$ and the sill $3'' \times 4''$. Scale $\frac{1}{12}$.

FREEHAND, MODEL AND PERSPECTIVE DRAWING. *Time*—3 hours.

1. Copy the drawings on the accompanying sheet to $\frac{3}{4}$ scale.

2. Make fully dimensioned hand sketches of the model placed before you such that detailed drawing could be made from your sketches if necessary.

3. Draw the perspective picture of a block of steps 10 feet long of which the end elevation is given on the accompanying sheet. The line *AB* is on the ground plane and vanishes towards the right at an angle of 45° with the picture plane, *A* being directly opposite the spectator and 2 feet within the picture. Scale $\frac{1}{4}$ inch to one foot.

CHAIN, COMPASS AND PLANE TABLE SURVEY. *Time*—3 hours.

1. Plot the following compass traverse. Scale 100 feet = 1 inch.

Readings at	Distances.
A $142\frac{3}{4}$	*AB* 816.
B $212\frac{1}{2}$	*BC* 515.
C $167\frac{1}{4}$	*CD* 220.
D $315\frac{1}{2}$	*DE* 724.
E $346\frac{3}{4}$	*EF* 733.
F $119\frac{1}{4}$	*FG* 350.
G 355	*GH* 300.

What is the bearing and length of the closing line *HA*?

2. Plot the following chain survey. Scale 100 feet=1 inch.

AB 763
AD 603
BD 555
BE 582
AE 453
DE 790

BF 286.
EF 296.
FG 395.
GE 539.
DG 960.

Engineer Subordinate Class, 2nd Division.

3. In question 2 plot the accompanying extracts from the field book.

4. Find the area of the traverse of question No. 1 in acres and decimals.

5. How would you chain down a very irregular and steep slope?

6. Supposing the length of your chain is found to be 100·27 feet, what is the true length of a line which has been measured 1,573 feet?

7. How would you, by the aid of flags only, find a point in line between two inaccessible marks?

LEVELLING. *Time*—3 hours.

1. If your instrument is out of adjustment what precautions would you adopt in the field to prevent errors accumulating?

2. What considerations guide you as to choice of bench marks?

3. How would you lay out a contour line?

4. How would you perform the permanent adjustments of a Dumpy level?

How often would you check these adjustments?

5. Complete the following extract from a level book and plot the section to a scale 100 feet = 1 inch horizontal and 10 feet = 1 inch vertical:—

Back.	Inter.	Fore.	Distance.	——
0·22			0	
1·12		13·75		
0·35		13·98		
	2·15		100	
	10·41		170	
	15·00		175	
	14·75		195	
	13·95		200	
	10·54			B.M. or stone 123 feet to right 525·25.
	10·21		300	
13·52		0·26		
12·98		0·13		
	10·15		400	
		7·15		

6. Plot the following cross sections which were taken on the longitudinal section of question 5 to a scale of 20 feet = 1 inch:-

	Reading.	
At 100	13·95	150 left.
	10·22	50 „
	8·25	Centre peg.
	2·31	70 right.
	2·10	100 „

Engineer Subordinate Class, 2nd Division.

At 200	14·00	150 left.
	13·40	100 „
	10·35	30 „
	8·10	Peg.
	4·20	25 right.
	3·15	100 „
At 300	12·52	150 left.
	9·15	100 „
	10·42	45 „
	7·50	Centre peg.
	6·19	33 right.
	4·40	100 „
At 400	10·10	100 left.
	13·95	50 „
	9·72	Centre peg.
	3·21	10 right.
	7·15	100 „

7. Find the areas of each cross section and calculate the quantity of earthwork in the two centre chains. Formation level at 0 is 560 and falls with a gradient of 1 in 30; formation width 20 feet; slopes 2 to 1; the ground may be assumed level at 0.

Engineer Subordinate Class, 3rd Division.

ARITHMETIC AND ALGEBRA. *Time*—3 hours.

1. Give the sum of each of the following columns without copying them out:—

	cd.	md.	v.	plm.
3472853	350	18	2	29
59482	29	7	6	32
637475	47	9	3	6
721803	231	3	7	15
2821	46	12	0	7
6248625	53	2	1	22
57329	2	14	5	18
1469032	129	8	6	31
374803	786	13	4	10
582910	89	0	6	9
3802	58	6	5	1
4261734	7	19	1	37
98206	542	6	7	16
817253	63	11	1	23

2. Find the quotient of 2843·57628 by 381·291347 to four places of decimals.

3. Find the value of 427 md. 6 v. 13 plm. at Rs. 23-5-6 per maund.

4. A cistern which can hold 800 gallons measures externally 5 feet 6 inches by 4 feet 8 inches by 5 feet 5½ inches. The sides are 1 inch thick. Find the thickness of the bottom, supposing 6¼ gallons = 1 cubic foot.

Engineer Subordinate Class, 3rd Division.

5. When exchange on London at New York is 4·85 dollars per £1 and at Madras is 1*s.* 1$\frac{5}{16}$*d.* per rupee, what will a draft for 764 dollars at New York cost in Madras?

6. How much would it cost to buy Rs. 5,000 3½ per cent. Government paper when it is at Rs. 109–6–0, and what percentage would be obtained for the money invested (brokerage ¼)?

7. Simplify—

$$\frac{p-a}{x-a}+\frac{p-b}{x-b}-\frac{p+a}{x+a}-\frac{p+b}{x+b}$$

when $x=\sqrt{ab}$; and reduce to its simplest form

$$\left(\frac{x^3-3x+2}{x^3+2x^2+2x+1}\right)\times\left(\frac{x^2+2x+1}{x^2-5x+4}\right).$$

8. Resolve into factors—

$$\left(\frac{p-1}{p+1}\right)x^2+2\left(\frac{p^2+1}{p^2-1}\right)xy+\left(\frac{p+1}{p-1}\right)y^2$$

and

$$x^3-(a-2b)x^2+(b^2-c^2-2ab)x-a(b^2-c^2);$$

and find the G.C.M. of

$$x^4-2x^3-x+2 \text{ and } x^4-4x^3+6x^2-5x+2.$$

9. Solve the equations—

$$\frac{(1-a^2)(1-b^2)}{(1+ax)(1+bx)}=(1-ax)(1-bx);$$

$$\sqrt{\frac{x^2+x+1}{x^2-x+1}}-\sqrt{\frac{x^2-x+1}{x^2+x+1}}=1.$$

10. Two persons, *A* and *B*, set out on a journey. *B* starts *h* hours before *A*; and *A*, who travels *m* miles an hour faster than *B*, overtakes him *n* miles from the starting place. Find the speeds of *A* and *B*.

BUILDING MATERIALS. *Time*—3 hours.

1. What are the characteristics of good building stones and into what classes are they divided? Describe and classify—Granite, laterite, kunkar, flint, and state for what purposes they are most useful.

2. Describe the process of brick-making at the Government brick-fields, Madras, with four sketches and a detailed description of the Hoffman's kiln. What are the advantages and disadvantages of this kiln?

3. What is the object of glazing bricks and tiles and how is a transparent glaze effected.

4. How are limes classed? Describe the process of slaking and state the precautions which should be observed. Why cannot a fat lime set or harden in damp places?

5. To what forms of decay is timber specially liable and how can they be retarded?

Engineer Subordinate Class, 3rd Division.

6. When is iron said to be "red short" and "cold short" and to what cause are these defects due? How can the defect of "red shortness" be avoided?

7. Sketch with dimensions a treble riveted lap joint. Plates ⅛ inch thick and rivets ¼ inch diameter. Give also a fully dimensioned sketch of a rivet before and after clenching.

8. What is the usual basis of an oil paint and what is the object of each constituent. Describe the process of painting on plaster.

GEOMETRICAL DRAWING. *Time*—3 hours.

1. Draw a square 2 inches side. On each diagonal as a base draw two equilateral triangles and in each of these four triangles inscribe a circle.

2. Divide a square, 2 inches side, into seven equal parts by lines drawn through one of its corners.

3. Construct a square and an equilateral triangle each having an area of 3·8 square inches. The solution must be entirely goemetrical.

4. Draw a line the square on which shall be equal to the sum of the squares on lines ½, ¾, 1 and 1½ inches long.

5. Describe a circle which shall touch a line *AB*, 3 inches long, at a point one inch from *A* and also touch a circle, one inch diameter, whose centre is in a line at right angles to and two inches above *B*.

6. The scale on a certain plan is 20 Spanish palms to an inch. Construct a corresponding scale of English feet taking the palm as 0·68 English feet. Show 50 feet and write down the representative fraction.

7. Draw the plan of a square 2 inches side when its plane is inclined 42° and the diagonal is horizontal.

8. Draw the plan of a right pyramid, whose base is a hexagon 2 inches side and its axis 3 inches, when it stands upright upon a horizontal plane. Give the section by a vertical plane which cuts off half of one edge and a quarter of the next measuring downwards from the vertex. The base of the pyramid not to be placed symmetrically.

9. The span of a semi-elliptic arch is 96 feet; its height is 32 feet thickness at crown 4 feet; at springing 5½ feet. Draw the elevation of the arch to a scale $\frac{1}{200}$.

NOTE.—Constructions to be strictly geometrical, and particular care to be taken not to efface lines necessary for a correct solution. Construction lines to be dotted. All lines to be inked if time permits.

Draftsman Class, 1st Division.

MACHINE DRAWING. *Time*—4 hours.

1. Draw to scale half size plan elevation and sections of the screw bottle jack shown in the accompanying hand sketch.

Draftsman Class, 1st Division.

2. A shaft 2′ 0″ long 3″ diameter has a neck or bearing 4″ long and ″ diameter turned in it 8″ from one end, 6 inches from the bearing sunk key is, let into the shaft the key being 6″ long ¾″ wide ½″ thick per 1 in 12. Draw the shaft showing the bearing and the key.

3. Ink in and colour as much of No. 1 or No. 2 as time will rmit.

TOPOGRAPHICAL DRAWING. *Time*—3 hours.

1. On the paper which you use for question 3 print the following ding. The words to be suitably arranged and of suitable size and m. The scale to be drawn and its representative fraction given.

Plan of a Railway. Scale $\frac{1}{\rule{4em}{0.4pt}}$

2. Construct a scale $\frac{1}{60}$ to represent yards and feet.

3. Make a plan of a railway one mile long partly in embankment d partly in cutting, showing the country on either side for a width of mile and introducing a station, roads, village, hills and any other tails. Scale 12 inches to a mile.

4. Draw on your paper a rectangle, 12″ × 6″, and divide it into ht equal squares. In one of the squares draw the contoured plan a right irregular cone, 3 inches diameter at base and 2 inches high, apex being vertically over a point in the diagonal of the square inches from one corner and the contours ¼ inch apart; in another w a shaded plan of the same cone; and in the remaining squares w a flat tint of light and dark indian ink and the following conven-al signs:—A tank, wet cultivation, village, hills, road with avenue, anut tope, river with islands, high ground.

BUILDING DRAWING (BRIDGES AND IRRIGATION WORKS). *Time*—4 hours.

1. The drawing represents the half elevation and half longi-nal section of a single arch 10 feet culvert. From the data given w make a drawing to a scale $\frac{1}{50}$ of a culvert of 2 spans of 10 feet; ng (1) ½ elevation; (2) ½ longitudinal section; (3) ½ plan at top; (4) an at floor level; (5) section through crown of arch; (6) section of g wall.

DATA.

Foundation and floor under arch to be of concrete 2½ feet thick e foot offset all round.

Superstructure to be of brickwork.

Arch to be semicircular 5 feet radius and 15 inches thick.

ing walls to be plumb faced and to have a back batter 1 in 4 y of 1 to 1. The slope of the upper surface to be 1½ to 1 to The breadth to be 15 inches at top measured on the square ight to be equal to height of formation or line of top of bank alling.

Draftsman Class, 1st Division.

Centre pier to be 2½ feet thick and to have a suitable cu water at the upstream end.

Parapets to be as shown and 15 inches thick. To be set o 3 inches and to have guard stones.

The culvert to be suitable for a road 20 feet wide with si slopes 1½ to 1. The drawings to be fully dimensioned and finishe Scale to be drawn.

2. Ink in your drawings and print the heading: "Buildir Drawing (Bridges and Irrigation Works);" also the name of each vie

FREEHAND, MODEL AND PERSPECTIVE DRAWING. *Time*—3 hours.

1. Copy the drawings on the accompanying sheet to ¾ scale.

2. Make fully dimensioned hand sketches of the model place before you such that detailed drawing could be made from your sketche if necessary.

3. Draw the perspective picture of a block of steps 10 feet long o which the end elevation is given on the accompanying sheet. The lin *AB* is on the ground plane and vanishes towards the right at an ang of 45° with the picture plane, *A* being directly opposite the spectat and 2 feet within the picture. Scale ¼ inch to one foot.

ESTIMATING. *Time*—4 hours.

Take out fully and in detail the quantity of each description work (1) in the weir, (2) in the latrine shown on the accompanying drawings; abstract these in estimate form and estimate the cost.

SPECIFICATION FOR WEIR.

Foundations.—To be of concrete as shown.

Superstructure.—To be brick in chunam pointed.

RATES FOR WEIR.

Concrete Rs. 10 per 100 c. ft.; brickwork Rs. 20 per 100 c. ft.; pointing Rs. 1-8-0 per square.

SPECIFICATION FOR LATRINE.

Foundations.—To be of concrete as shown.

Superstructure.—To be brickwork in chunam.

Woodwork.—To be Burma teak.

Door.—A 2″ framed and battened door to be provided. The bases for uprights of frame to be of stone.

Roof.—To be single tiled (battens 3″ × 2″; ridge batten 3″ × 4″; wall plates 4″ × 3″).

Floor.—To be of rammed clay 8″ thick.

Interior and exterior fittings.—The interior to be colour-washed, exterior pointed. The seat to be of teak-wood resting on a slab of dressed stone. All wood work to be painted two coats.

Draftsman Class, 1st Division.

inth protection.—To be of rammed kunkar of an average thick-¼ inches.

RATES FOR LATRINE.

arthwork Rs. 3–8–0 per 1,000 c. ft.; concrete Rs. 16 per 100 rammed kunkar Rs. 2–8–0 per 100 c. ft.; rammed clay Re. 1 0 c. ft.; brickwork (including archwork and pointing) Rs. 25 per ft.; cornices As. 4 per running foot; dressed stone Re. 1 per colour-washing As. 4 per square; single tiling Rs. 8 per square; y Rs. 1–8–0 per sq. ft.; timber framed and fixed Rs. 3–8–0 per painting Rs. 4 per square.

GEOMETRICAL DRAWING. *Time*—3 hours.

Draftsman Class, 2nd Division.

. Draw an equilateral triangle of 2 inches side and four circles, touching one side of that triangle and the other two or those two ced.

. On a line 2 inches long construct an isosceles triangle with a al angle of 50°, and construct a square of equal area with the le.

. Draw a circle of 3 inches diameter with centre O. The corners olygon inscribed in this circle are so placed that the angles at the are:—$AOB = 60°$; $BOC = 120°$; $COD = 100°$. Write down ngths of AB, BC, CD, and DA.

. Construct the quantity $\sqrt{a^2 + 5b^2}$ when $a = 1$ inch and $b =$ h without extracting the square root.

. In a circle, 1·7 inches radius, inscribe three equal circles, each ing the circumscribing circle and the two inscribed circles.

. Describe a circle, 1½ inches radius, and in it inscribe an equi- l and equiangular pentagon.

7. A pentagonal surface, side one inch, is inclined 40° with the of the paper and the line joining two alternate corners of the is horizontal; draw the plan and elevation.

8. Determine the plan and elevation of an octohedron of side ches when it rests with one of its triangular faces upon the paper.

9. Draw the isometric view of a box, 18″ × 9″ × 6″, with the lid at an angle of 60°. The box is made of ½ inch deal. Scale ches to a foot.

NOTE.—Constructions to be strictly geometrical, and particular to be taken not to efface lines necessary for a correct solution. truction lines to be dotted. All lines should be inked if time its.

BUILDING DRAWING (BUILDINGS). *Time*—4 hours.

1. Draw the ½ outside and ½ inside elevations and horizontal and cal sections of a window opening, 4′ 6″ × 2′ 3″, in a wall, 1½ s thick, built in English bond. The reveal to be covered by a ed arch, 12 inches deep, and the jamb by a lintel 3 inches thick, and ieving arch in two rings. The sill stone to be 2′ 7½″ × 6″ × 11.″

Draftsman Class, 2nd Division.

Bricks 9" × 4½" × 3". Scale ½ inch to one foot. Show two feet of wall all round opening.

2. Make detailed drawings of a venetian window suitable for the opening in question 1. The scantling of the frame to be 4" × 3½" properly framed and morticed, rebated ½ inch wide to the full thickness of the shutter and to have a return bead moulded on the other side. The shutter to be of two equal panels filled with venetians. Stiles and rails to be 3" × 1¼". Venetian blades 3½ inches wide and ⅜ inches thick and to overlap about half their width. The ends of blades to be rounded off at centre to ⅜ inch diameter and ¾ inch long and round holes to be made in the sides of the rebate in the frame to receive them. The venetian blades to be attached to stanchions ¾" × ½".

The drawings required are (1) outside and inside elevations and vertical section through venetians to a scale $\frac{1}{12}$; (2) section through venetians showing rebate in side of frame and a plan of a venetian blade to a scale ⅛.

3. If you have time ink in and colour your drawings.

Surveyor Class, 1st Division.

THEODOLITE SURVEY. *Time*—3 hours.

NOTE.—*Questions 2 and 7 are alternative. Both are not to be attempted.*

1. Practical question, (adjustments of theodolite).

2. It is proposed to put in a diversion 50 feet distant from and parallel to a main line of railway which is on the straight. The diversion is joined to the main line at either end by reverse curves 1,000 feet radius with 100 feet of straight beween. Assuming the central straight portion of the diversion to be 1,000 feet in length, what will be the total length measured along the main line between the beginning and end of the diversion?

3. Explain how you would set out the diversion of question 2 practically on the ground.

4. The intersection of two straight lines makes an angle of 154° 30′. The tangent must be 432·16 feet in length. What will be the radius, versine and length of the curve?

5. Compute by Gale's method the area of the following survey. Take the meridian through *A* as the base line of the plot.

Observed angles.		Length.		Remarks.
F				
A	87° 48′	*AB*	1202′	Bearing of line AB = 75° 32′ N.E.
B	144° 57′	*BC*	1110′	
C	69° 32′	*CD*	850′	
D	120° 43′	*DE*	802′	
E	226° 50′	*EF*	705′	
F	70° 10′	*FA*	1060′	
A				

Surveyor Class, 1st Division.

6. Solve the following triangle:—

Observed angle at H $29^\circ 58' 33\frac{1}{3}''$
B $46^\circ 28' 23\frac{1}{3}''$ $BD = 295{\cdot}806$ feet.
D $103^\circ 32' 33\frac{1}{3}''$

7. The altitude of the top of an obelisk read at two points A and B in line with the obelisk is 44° 23′ and 35° 12′ respectively. The measured distance A to B is 250 feet and the altitude of the ground at A as read at B is $+5^\circ 33'$.

The height of the instrument at A was 4·23 feet and at B 4·75 feet. The reduced level of B is 100·29. What is the reduced level of the top of the obelisk?

LEVELLING. *Time*—3 hours.

1. If your instrument is out of adjustment what precautions would you adopt in the field to prevent errors accumulating?

2. What considerations guide you as to choice of bench marks?

3. How would you lay out a contour line?

4. How would you perform the permanent adjustments of a Dumpy level?

How often would you check these adjustments?

5. Complete the following extract from a level book and plot the section to a scale 100 feet = 1 inch horizontal and 10 feet = 1 inch vertical:—

Back.	Inter.	Fore.	Distance.	——
0·22			0	
1·12		13·75		
0·35		13·98		
	2·15		100	
	10·41		170	
	15·00		175	
	14·75		195	
	13·95		200	
	10·54			B.M. or stone 123 feet to right 525·25.
	10·21		300	
13·52		0·26		
12·98		0·13		
	10·15		400	
		7·15		

6. Plot the following cross sections which were taken on the longitudinal section of question 5 to a scale of 20 feet = 1 inch:—

	Reading.	
At 100	13·95	150 left.
	10·22	50 „

Surveyor Class, 1st Division.

	2·31	70 right.
	2·10	100 ,,
At 200	14·00	150 left.
	13·40	100 ,,
	10·35	30 ,,
	8·10	Peg.
	4·20	25 right.
	3·15	100 ,,
At 300	12·52	150 left.
	9·15	100 ,,
	10·42	45 ,,
	7·50	Centre peg.
	6·19	33 right.
	4·40	100 ,,
At 400	10·10	100 left.
	13 95	50 ,,
	9 72	Centre peg.
	3·21	10 right.
	7·15	100 ,,

7. Find the areas of each cross section and calculate the quantity of earthwork in the two centre chains. Formation level at 0 is 560 and falls with a gradient of 1 in 30; formation width 20 feet; slopes 2 to 1; the ground may be assumed level at 0.

Topographical Drawing. *Time*—3 hours.

1. On the paper which you use for question 3 print the following heading. The words to be suitably arranged and of suitable size and form. The scale to be drawn and its representative fraction given.

Plan of a Railway. Scale $\frac{1}{\qquad}$

2. Construct a scale $\frac{1}{60}$ to represent yards and feet.

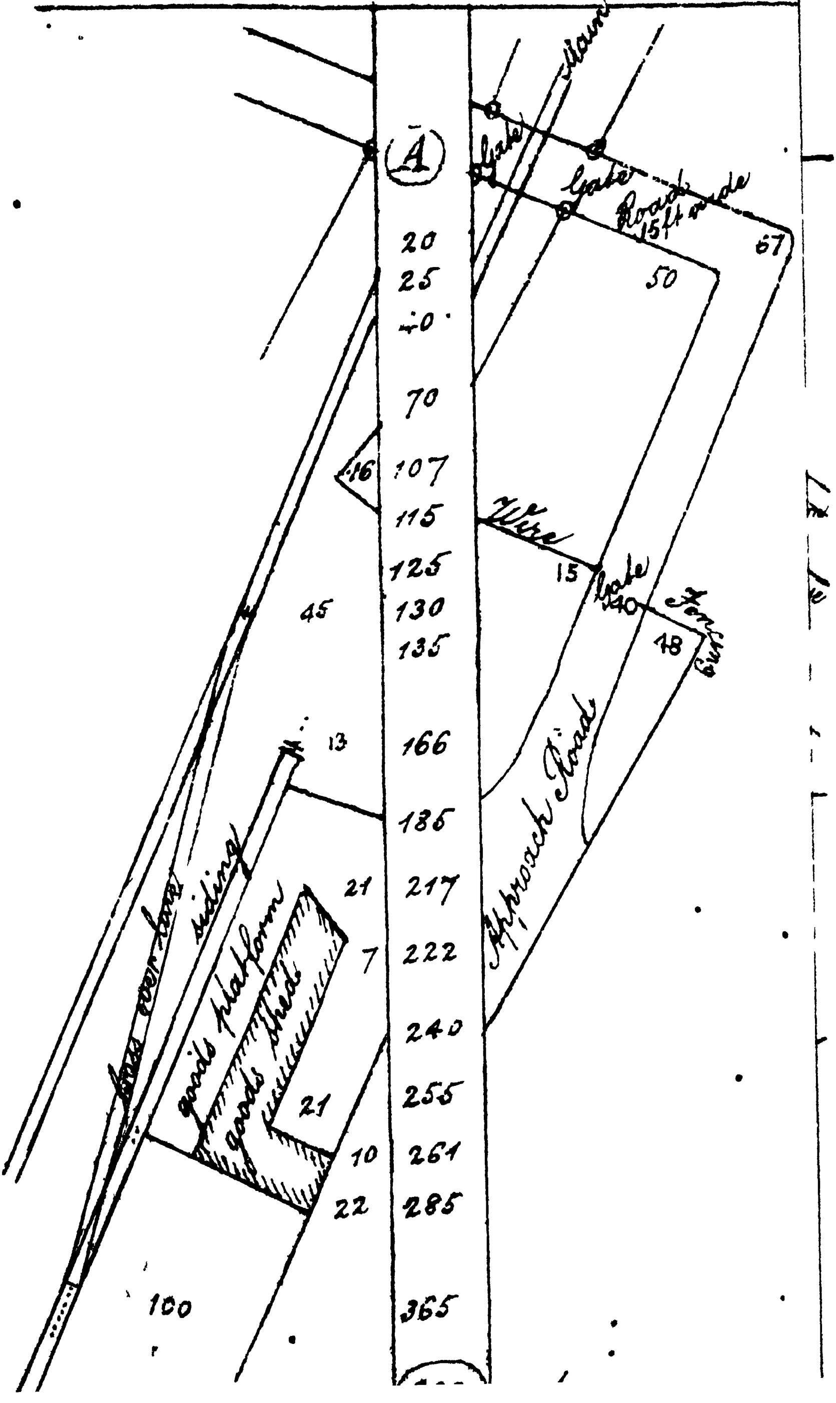
3. Make a plan of a railway one mile long partly in embankment and partly in cutting, showing the country on either side for a width of ¼ mile and introducing a station, roads, village, hills and any other details. Scale 12 inches to a mile.

3. Draw on your paper a rectangle, 12″ × 6″, and divide it into eight equal squares. In one of the squares draw the contoured plan of a right irregular cone, 3 inches diameter at base and 2 inches high, the apex being vertically over a point in the diagonal of the square 1½ inches from one corner and the contours ¼ inch apart; in another show a shaded plan of the same cone; and in the remaining squares show a flat tint of light and dark indian ink and the following conventional signs:—A tank, wet cultivation, village, hills, road with avenue, cocoanut tope, river with islands, high ground.

SURVEYOR CLASS

Chain Compass and Plane Table Surv

Question 2



Surveyor Class, 2nd Division.

CHAIN, COMPASS AND PLANE TABLE SURVEY. *Time*—3 hours.

1. Plot the following compass traverse. Scale 100 feet = 1 inch.

Readings at	Distances.
A 142¾	*AB* 816.
B 212⅓	*BC* 515.
C 167¼	*CD* 220.
D 315⅓	*DE* 724.
E 346¾	*EF* 733.
F 119¼	*FG* 350.
G 355	*GH* 300.

What is the bearing and length of the closing line *HA* ?

2. Plot the following chain survey. Scale 100 feet = 1 inch.

AB 763	*BF* 286.
AD 603	*EF* 296.
BD 555	*FG* 395.
BE 582	*GE* 539.
AE 453	*DG* 960.
DE 790	

3. In question 2 plot the accompanying extracts from the field book.

4. Find the area of the traverse of question No. 1 in acres and decimals.

5. How would you chain down a very irregular and steep slope ?

6. Supposing the length of your chain is found to be 100·27 feet, what is the true length of a line which has been measured 1,573 feet ?

7. How would you, by the aid of flags only, find a point in line between two inaccessible marks ?

II. ENTRANCE EXAMINATIONS OF 1895.

(1) ENGINEER CLASS—DECEMBER.

Entrance Examination, Engineer Class.

ARITHMETIC, ALGEBRA AND MENSURATION. *Time*—3 hours.

1. (*a*) Divide five million by 1,970. What is the nearest whole mber to five million which is exactly divisible by 1,970 ?

(*b*) Simplify $\frac{24,909}{27,588}$ and $\frac{13\cdot806}{\cdot0121} \div \cdot1\dot{1}\dot{8}$.

2. Having given 1 grain = ·065 grammes, show that a kilogramme ,000 grammes) = 2·2 lbs. avoirdupois very nearly ; and express 1 cwt. kilogrammes.

3. A square field contains 15 acres 2 ro. 20 per. Find the length a pathway crossing it diagonally correct to inches.

4. Calculate to the nearest pie, the true discount value of a bill Rs. 952–8–0 payable on December 31st and discounted on July 17th ½ per cent. per annum.

5. A person sold 35 Bank of Madras shares and invested the ceeds in the Government 3½ per cents. when they were at 3¼

after

Entrance Examination, Engineer Class.

income-tax at the rate of 5 pies in the rupee be Rs. 1,187–3–0, find the price at which he sold each of his bank shares.

6. Resolve into factors—

(i) $(b-c)(x-a)^3 + (c-a)(x-b)^3 + (a-b)(x-c)^3$.

(ii) $abc(a^3 + b^3 + c^3) - (a^3b^3 + b^3c^3 + c^3a^3)$.

7. Solve the following equations:—

(i) $16x(x + 1)(x + 2)(x + 3) = 9$.

(ii) $x^2 + xy + y^2 = 7$; $x^4 + x^2y^2 + y^4 = 133$.

(iii) $x + y + z = a + b + c$;
$(b - c)x + (c - a)y + (a - b)z = 0$;
$x^2 + y^2 + z^2 = a^2 + b^2 + c^2$.

8. Sum to n terms—

(i) $\frac{1}{x} + \frac{2}{x^2} + \frac{3}{x^3} + \dots\dots$

(ii) $1^3 + 3^3 + 5^3 + 7^3 + \dots\dots$

9. (i) Find the number of terms in the expansion of $(a + b + c + d)^{15}$.

(ii) If a, b, c, d be four consecutive coefficients in the expansion of a binomial, prove that $\frac{a}{a+b}$, $\frac{b}{b+c}$, $\frac{c}{c+d}$, are in *A.P.*

(iii) Obtain the coefficient of x^{15} in the expansion of $(1 - 5x + bx^2)^{10}$ in ascending powers of x.

10. In driving a gig round a circular lawn it was observed that the wheel which was kept close to the grass made only four turns, while the outer wheel which was on the gravel made six. Calculate the area of the lawn, the wheels being 5 feet apart on the axle.

11. What is the volume of a spherical zone, the diameters of whose ends are 10 and 12 inches and whose height is 2 inches? Compare the curved surface of the zone with that of the sphere of which it is a part.

12. A cylindrical jar 5 inches in diameter and full of water is tilted until $2\frac{1}{2}$ lbs. of water run out. How far is the surface below the upper edge of the cylinder? If the water be now poured from the cylinder into a hollow inverted cone of vertical angle 60°, how high will the water rise in it, the axis being supposed to be vertical.

GEOMETRY AND PLANE TRIGONOMETRY. *Time*—2 hours.

1. Inscribe a square in a given triangle.

2. The opposite angles of any quadrilateral inscribed in a circle are supplementary. If the opposite sides of the quadrilateral be produced to meet in P, Q and about the triangles so formed without the quadrilateral circles be described meeting again in R, the three points P, Q, R will be in one straight line.

3. Describe an isosceles triangle having each of the angles at the base double of the vertical angle.

If BC be the base of such a triangle ABC and D, E, F the mid points of BC, CA, AB and if the circle through D, E, F cut the sides AB, AC again at G and H respectively, prove that the figure $DHEFG$ is a regular pentagon.

Entrance Examination, Engineer Class.

4. If four straight lines be proportionals, the rectangle contained by the extremes is equal to the rectangle contained by the means.

EA, EA' are diameters of two circles touching each other externally at E; a chord AB of the former circle, when produced, touches the latter at C, while a chord $A'B'$ of the latter touches the former at C; prove that—

$$AB.A'B' = 4BC'.B'C.$$

5. Prove the following identities:—

(i) $\frac{\pi}{4} = \cos^{-1}\frac{4}{5} - \sin^{-1}\frac{1}{\sqrt{10}} + \tan^{1}\frac{1}{2}$.

(ii) $\cos 4^\circ 30' + \sin 7^\circ 30' + \sin 37^\circ 30' - \cos 40^\circ 30' = 4 \sin 22^\circ 30'. \cos 28^\circ 30'. \cos 43^\circ 30'$.

6. Solve the following equations:—

(i) $\sin^2 2\theta - \sin^2\theta = \frac{1}{4}\sin 3\theta$.

(ii) $\tan(3x + 2y) = -1; \sin(2x - y) = -\frac{1}{\sqrt{2}}$.

7. (i) Prove that, in any triangle,

$R = (r_1 - r)(r_2 - r)(r_3 - r)/4r^2$.

(ii) If the bisector of the angle A of a triangl[illegible] ABC meet BC in Q and the circum-circle in L, then $AL = 2R\cos\frac{B-C}{2}$ and $QL = a^2 \sec\frac{A}{2}/2(b + c)$.

8. If in a triangle $a = 35$, $c = 20$, $A = 107^\circ 25'$ find C, having given that—

$\log 2 = \cdot 3010300$; $\log 3\cdot 5 = \cdot 5440680$; $L \sin A = 9\cdot 9796182$
$L \sin 33^\circ 2' = 9\cdot 7364976$; $L \sin 33^\circ 3' = 9\cdot 7366918$.

9. A man at an elevation of 200 feet observes an object due S. to have an angle of depression of 30° and another S.W. to have an angle of depression of 60°. Find how far apart the two objects are.

ENGLISH COMPOSITION AND HANDWRITING. *Time*—1 hour.

Write an essay on *one* of the following subjects:—

(1) The choice of a profession.
(2) School life in India.
(3) Your native village.

(2) ENGINEER SUBORDINATE CLASS—CIVIL CANDIDATES, APRIL.

ARITHMETIC AND ALGEBRA. *Time*—3 hours.

Entrance Examination, Subordinate Class, Civil.

1. Find the G.C.M. of 1,901,235 and 4,320,960.

Entrance Examination, Subordinate Class, Civil.

2. Simplify—

$$\frac{\frac{5}{14} - \frac{3}{7} \text{ of } \frac{1}{3} + 12\frac{4}{7}}{\frac{5}{16} + 1\frac{7}{12} \text{ of } 3\frac{1}{4} - (\frac{7}{8} \text{ of } \frac{37}{21} - \frac{1}{3})}.$$

3. Divide $\cdot\dot{6}\dot{3} \times \cdot\dot{6}\dot{3} - \cdot41\dot{6} \times \cdot41\dot{6}$ by $1\cdot05\dot{3}\dot{0}$.

4. What income will a person obtain in England from one lakh of rupees, Indian Government $4\frac{1}{2}$ per cent. bonds, when for drawing and remitting it his agents in India chargo him 3 per cent. and exchange is at 1*s.* $2\frac{1}{4}$*d.* for the rupee?

5. A mass of lead ore weighed 7 tons; one portion of it yielded lead 78°/₀ and silver 8 oz. per ton; the remaining portion yielded lead 75°/₀ and silver $7\frac{1}{2}$ oz. per ton. The total yield of silver was 55 oz. What average per cent. of lead did the whole mass contain?

6. Find to within an inch the length of the diagonal of a square field whose area is 5 acres.

7. The dimensions of a rectangular room are 25 *feet* 4 *inches* by 18 *feet* by 13 *feet* 6 *inches*; find how many cubic feet of air must be supplied per second in order that the whole atmosphere of the room may be renewed in an hour.

8. What principal will amount to £501-12-9 in three years at 5°/₀ per annum *compound interest?*

9. I[illegible] $- \frac{1}{x} = a$, find the value of $x^5 - \frac{1}{x^5}$ in terms of a.

Prove that $2\{x^4 + (x-y)^4 + (2x-y)^4\}$ is a perfect square.

10. Simplify (1) $\frac{3}{2+2x} - \frac{4}{3-3x} + \frac{5}{4-4x^2}$.

(2) $$\left(1 - \frac{2a}{a + \frac{z^2}{a}}\right)\left(1 + \frac{3a}{a - \frac{z^2}{a}}\right) \div \left(1 - \frac{a}{z-a}\right)\left(1 + \frac{a}{z+a}\right).$$

11. Solve the equations—

(1) $\frac{1-x}{2} = \frac{3+x}{3} - \frac{9+x}{4}$.

(2) $ax - by = a^2 - ab$; $ay - bx = b^2 - ab$.

(3) $12x^2 - 335x = 623$.

ENGLISH COMPOSITION AND HANDWRITING. *Time*—$1\frac{1}{2}$ hours.

1. Explain the following sentences:—
   - (*a*) He soon got out of his depth.
   - (*b*) He was the lion of the season.
   - (*c*) It was a scene of confusion which beggared description.
   - (*d*) God tempers the wind to the shorn lamb.

2. Give the remaining degrees of comparison of *far*, *little*, *next*, *worse*, and the plurals of *echo*, *grotto*, *die*, *scarf*, *shot*, *terminus.*

3. Correct *or justify* the following sentences:—
   - (*a*) No one acted nobler or more suitable to a great emergency.

Entrance Examination, Subordinate Class, Civil.

(*b*) He has never told me not to do it.
(*c*) He ordered me lay down for ten minutes.
(*d*) You did not act at all manly on that occasion.

4. Write an essay of about 40 lines or 240 words on—
"The duty of children towards their parents."

GEOMETRY. *Time*—1½ hours.

1. Triangles on the same base and between the same parallels are equal to one another.

2. P, Q, R, S are the middle points of the sides of a quadrilateral $ABCD$ taken in order. Prove that the area of $PQRS$ is half that of the quadrilateral.

3. If a straight line AB be bisected at C and produced to D, prove by any method that the square on AD is equal to the square on BD together with four times the rectangle $AC \cdot CD$.

4. Show by a diagram that if x, y represent the lengths of two straight lines,

5. Two circles touch each other externally at A; show that each of the common tangents not passing through A subtends a right angle at that point.

6. Circumscribe a regular pentagon about a given circle.

7. If from any point on the circumference of a given circle straight lines be drawn to the four angular points of an inscribed square, the sum of the squares on the four straight lines is double the square on the diameter.

(3) ENGINEER SUBORDINATE CLASS—MILITARY CANDIDATES, APRIL.

ARITHMETIC. *Time*—3 hours.

Entrance Examination, Subordinate Class, Military.

1. Find the number of rupees equal in value to three millions, four thousand, two hundred and twenty-four pies.

2. Find the value of—
$\frac{1}{4}$ of 17*s.* 8*d.* + 2·625 of 1*s.* — $\frac{3}{4}$ of $\frac{5}{8}$ of 5*s.* 4*d.* + $\cdot 26\dot{3}$ of 25*s.*, and reduce the result to the decimal of £5.

3. Express the following vulgar fractions as repeating decimals:
$\frac{5}{3}$, $\frac{44}{9}$, $3\frac{59}{96}$, $\frac{209}{450}$, $\frac{108}{180}$.

4. Simplify—

$$\text{i.}\quad \frac{8\frac{6}{5} - 7\frac{3}{4} + 5\frac{2}{3} - 4\frac{1}{2}}{13 - 11\frac{9}{10} + 10\frac{7}{9} - 9\frac{17}{20}} \times \frac{72}{11} \text{ of } 365.$$

$$\text{ii.}\quad \frac{6 + \dfrac{1}{6 - \frac{1}{6}}}{4 - \dfrac{1}{4 - \frac{1}{4}}} \times 10\frac{8}{9}.$$

Entrance Examination, Subordinate Class, Military.

5. (*a*) Find the value of ·0013671875 of a mile expressing the result in yards, feet and inches, and (*b*) reduce 10 lb. 5 oz. to the decimal of a ton.

6. Extract the square roots of—
(*a*) 546,121, (*b*) $65\frac{64}{81}$, (*c*) 0·169 to six places of decimals.

7. Find by practice the value of a bar of gold weighing 5 lb. 10 oz. 12 dwts. $6\frac{3}{4}$ grs. at £3–17–11 per oz.

8. If 252 men can dig a trench 210 yards long, 3 wide and 2 deep in 5 days of 11 hours each; in how many days of 9 hours each will 22 men dig a trench 420 yards long, 5 wide and 3 deep?

9. *A* owes £3,000 bearing interest at £5 per cent. per annum; he pays at the end of each year for interest and in part-payment of the principal £500; find the amount of his debt at the end of the third year.

10. A clock, which is 4 minutes $8\frac{9}{32}$ seconds too fast at half past 9 A.M. on Tuesday, loses 2 minutes 45 seconds daily; what will be the time indicated by the clock at a quarter past 5 P.M. on the following Friday?

11. Find the present worth and discount of £275–6–8 at the end of 18 months at $4\frac{1}{2}$ per cent.

ENGLISH GRAMMAR AND COMPOSITION. *Time*—2 hours.

NOTE.—*Question 7 carries about half the total marks of the paper. Attention should be paid to handwriting, neatness and punctuation.*

1. Correct the following sentences where necessary:—
   (*a*) When he come in he went to lay down.
   (*b*) I never seed such a curious thing afore.
   (*c*) Neither of them was there.
   (*d*) If you was me would you do it?
   (*e*) They were all taken but one.

2. Analyse the following sentences:—
   (*a*) The horse is drawing a heavy load of bricks now.
   (*b*) Many birds build beautiful nests.
   (*c*) A big dog bit my sister's little boy yesterday.
   (*d*) The servant dusted every room carefully.

3. Give the plural of *calf*, *wife*, *shelf*, *elf*, *leaf*, *loaf*, *thief*, *hoof*, *staff*, *fife*, *proof*, *scarf*, *chief*, *dwarf*, *wharf*.

4. Give the comparative and superlative of the following adjectives:— *strong*, *hard*, *smooth*, *fine*, *coarse*, *pretty*, *healthy*, *big*, *fat*, *little*.

5. What is meant by the participles of a verb? Write down the perfect participles of *bloom*, *start*, *beseech*, *arrive*, *get*, *play*, *call*, *look*, *shrink*, *talk*, *act*, *smell*, *live*, *owe*, *see*, *dye*, *lie*, *lay*.

Pick out the imperfect participles and the words which they govern in the objective case—

My friends expecting me did not go out.
Do you see that little girl blowing bubbles.
The boys throwing stones hurt an old man.
The horses drawing the cart are thin.

Entrance Examination, Subordinate Class, Military.

6. Parse the following sentence :—

He returned to barracks thirty minutes late, so I placed him in confinement.

7. Write a brief description of the station at which you are serving.

DICTATION. *Time*—40 minutes.

The Superintendent is requested to read aloud the following passage clearly, so that the candidates may become acquainted with the subject; then to read it slowly while they take down the words; and again a third time in the ordinary manner to enable them to punctuate the passage and make any small corrections.

Taking everything into consideration, recruiting for the army during the past year may be considered perfectly satisfactory as regards numbers, since we have enlisted up to our full establishment. It is also satisfactory to note that there has been a considerable diminution in the number of men discharged as invalids under two years' service and also in the waste by desertion. The army is becoming more popular with all classes, and consequently the social position of our recruits is gradually improving. Their physique is as good as can be expected at present considering that, in order to get the numbers required, 20 to 25 per cent. have to be enlisted under regulation standard; but the development of these growing lads, after a few months' service, is remarkable, and will be still more so if the proposed new course of free gymnastics for recruits, to take place immediately after their enlistment, is introduced. This, combined with the improved system of cooking and other beneficial changes connected with the soldier's food, must in time have a good effect on the general physique of the whole army.

(4) DRAFTSMEN AND SURVEYORS—DECEMBER.

ARITHMETIC. *Time*—2 hours.

Entrance Examination, Draftsmen and Surveyors.

1. Divide 3478905321 by 239087, and express in words the sum of the quotient and remainder.

2. A tradesman's receipts of money in one week were :—Monday, £18-9-7; Tuesday, £15-4-8; Wednesday, £11-7-6; Thursday, £37-19-4; Friday, £14-8-3; Saturday, £7-14-2. What was the average daily receipt?

3. Find the cost of $876\frac{3}{4}$ yards of cloth at Rs. 2-13-4 per yard.

4. If the length of a man's step is 31 inches, how many steps does he take in walking 5 miles 6 furlongs and $89\frac{1}{3}$ yards?

5. Find the rent of 404 acres 1 rood 24 poles 20 square yards at Rs. 49-2-6 per acre.

6. Simplify—

(a) $\overline{\frac{1}{80} + \frac{1}{40} \text{ of } 2\frac{1}{2} \text{ of } 3\frac{1}{3} \text{ of } 5\frac{1}{5}}$.

(b) $1 \div [2 - 3 \div \{4 - 5 \div (16 - 7 \times \frac{2}{3})\}]$.

Entrance Examination, Draftsmen and Surveyors.

7. (*a*) Divide 4·48 by ·925 and $4\cdot4\dot{8}$ by $9\cdot\dot{2}\dot{5}$

(*b*) Find the difference between $\cdot0208\dot{3}$ of £1 and $\cdot02\dot{7}$ of 10*s*. 6*d*., and express this difference as the decimal of £1–9–4.

ENGLISH COMPOSITION AND HANDWRITING. *Time*—1 hour.

Write an essay descriptive of *one* of the following :—

(*a*) Your native village.
(*b*) A day spent at school.
(*c*) A day spent at home.
(*d*) Your favourite amusement.

(5) ACCOUNTS BRANCH, P.W.D., SEPTEMBER.

Entrance Examination, Accounts Branch.

ARITHMETIC. *Time*—2¾ hours.

1. (*a*) Multiply 90875063 by 79428, and divide the result by 19857.

(*b*) Simplify $\dfrac{\frac{3}{4} + \frac{6}{7} - \frac{5}{8}}{\frac{1}{14} + \frac{2}{7} + \frac{1}{16}} + \frac{11}{14} \times 2\frac{1}{3}$.

(*c*) Find the value of $\cdot6\dot{8}$ of Rs. 2 — $\cdot3\dot{8}$ of Rs. 1–2–4.

2. (*a*) Extract the cube root of 102503232.

(*b*) Extract the square root of 1·687841796875 to six places of decimals.

3. Divide £2,025 among *A*, *B*, *C*, *D* and *E*, so that *A's* share is to *B's* share as 1 : 2, *C's* share to *B's* share as 5 : 4, *D's* share to *C's* share as 6 : 5, and *E's* share to *D's* share as 4 : 3.

4. Find (by Practice) the price of 9 yards 1 foot 5⅓ inches at £2–5–7½ per yard.

5. If 17 men can build a wall 22 yards long 5 feet high and 1 foot thick in 9 days, working 11 hours a day, in how many days can 51 men build a wall 60 yards long 7 feet high and 2 feet thick, working 12 hours a day?

6. If I gain 15 per cent. by selling sugar at Rs. 3–2–0 per maund, cash, what do I gain or lose per cent. by selling it at Rs. 2–8–0 per maund with three months' credit? (Current rate of interest 5 per cent.)

7. Find the compound interest on Rs. 8,400 for 5 years at 8⅓ per cent. per annum.

8. The interest on a certain sum of money for two years is Rs. 715–5–0, and the discount for the same time is Rs. 638–8–0, simple interest reckoned in both cases. Find the rate per cent. per annum and the sum.

HANDWRITING. *Time*—½ hour.

The Candidate is required to copy the following in his ordinary handwriting.

1. The erection of a bridge, though the last process necessary in its construction, sometimes proves the most difficult, and allows of less

Entrance Examination, Accounts Branch.

certain calculation beforehand as to time, trouble and expense than either the manufacture of the structure or its transport to the site. The various methods of erection that have been adopted are dependent for success on so many circumstances that a full knowledge of each particular case is necessary in order to judge of comparative economy or safety. If there are difficulties to be overcome, it is of the utmost importance that they should be considered when the bridge is designed, and that the form of structure should not be decided on with reference only to the ultimate service that is required.

2. Reuter's London, 9th May 1895.

Liverpool Cotton Market:—Firm.

Good Westerns	$3\frac{1}{32}$
Middling Ceylon	101
Bar Silver	30 9/16
Consols	$106\frac{1}{8}$
$3\frac{1}{2}$°/₀ Rupee Paper	58 11/16
$4\frac{1}{2}$°/₀ do.	Unquotable
Sterling Loan	$115\frac{1}{4}$

Manchester Market:—Firm.

The demand is for light quantities for India.

MENSURATION. *Time*—$\frac{3}{4}$ hour.

N.B.—$\pi = 3{\cdot}1416$; $\sqrt{3} = 1{\cdot}732$.

1. The base of an isosceles triangle is 40 feet and the perpendicular height is half either side. Find the area.

2. Find the diagonal of a square field 5 acres in area.

3. There are as many feet in the circumference as square feet in the area of a circle. Find the diameter.

4. A right cone and a hemisphere are on opposite sides of a common base of 2 feet diameter, and the cone is 1 foot high. If a cylinder circumscribe them in this position, how much additional space is enclosed?

DICTATION. *Time*—$\frac{1}{2}$ hour.

One of the effects of a high state of civilization upon character is a relaxation of individual energy, or rather the concentration of it within the narrow sphere of the individual's money-getting pursuits. As civilization advances, every person becomes dependent, for more and more of what most nearly concerns him, not upon his own exertions, but upon the general arrangements of society. In a rude state, each man's personal security, the protection of his family, his property, his liberty itself depend greatly upon his bodily strength and his mental energy or cunning; in a civilized state, all this is secured to him by causes extrinsic to himself. The growing mildness of manners is a protection to him against much that he was before exposed to, while for the remainder he may rely with constantly increasing assurance upon the soldier, the policeman, and the judge, and upon the advancing

Entrance Examination, Accounts Branch.

strength of public opinion. There remain, as inducements to call forth energy of character, the desire of wealth or of personal aggrandizement, the passion of philanthropy and the love of active virtue.

BOOK-KEEPING. *Time*—1¾ hours.

1. What is the difference between a Promissory Note and a Bill or Draft?

2. Write out an explanation of the following terms as used in reference to Bills, Promissory Notes, Acceptances, Drafts, &c.:—*Discounting a Bill*, *Dishonouring a Bill*, *Arriving at Maturity*.

3. (*a*) Journalise the following transactions. (*b*) Post into the Ledger. (*c*) Prepare a Trial Balance.

1892.

Jan. 1.	Capital	Rs.	6,000
4.	Bought goods for cash	„	500
6.	Bought goods from T. Sarkey ..	„	2,000
8.	Sold goods to J. Tait	„	300
9.	Borrowed from P. English ..	„	1,000
12.	Paid T. Sarkey	„	1,500
„	Bought goods for cash	„	3,000
14.	Sold goods to A. James ..	„	700
15.	Received from J. Tait	„	200
23.	Sold goods to P. English ..	„	800
26.	Bought furniture	„	600
27.	Received from A. James ..	„	700
29.	Sold goods	„	100
31.	Sold goods to C. Burt	„	150

College of Engineering, Madras.

Entrance Examination for the Subordinate Establishment of the Accounts Branch, Public Works Department.
(Accountants, 8th Grade.)

REVISED RULES

Based on Government of India, Public Works Department Code, Appendix C, and Madras Government Order No. 2502 *W, dated 7th September* 1892.

1 Admission to the Subordinate Establishment of the Accounts Branch, Public Works Department, will, as a rule, be obtained in the Eighth Grade of Accountants. Appointments may be made direct, or from the establishment of accounts clerks in the offices of Examiners and Executive Engineers. All candidates for admission to the Accounts Branch must pass the examination described in paragraph 6 below, and must, unless they are in Government employ, or in a service pensionable by Government, be under 25 years of age at the time of appointment. Five appointments as accounts clerks in Executive Engineers' Offices will be reserved for persons who have passed the entrance Examination, and who are willing to accept general service.

2. The qualifications of a candidate for appointment as Accountant, Eighth Grade, will be attested by a certificate from the Principal, College of Engineering.

3. Candidates will be examined annually on the first Monday in September. The examination will be *ipso facto* invalidated if it be not begun and completed on that date; but the officer superintending the examination may make his own arrangements regarding *place* and *hour* of examination, with the candidates.

4. The examination will be held at the College of Engineering, Madras, and provincially at the office of any superior officer of the Public Works Department. Candidates for examination at the College will forward their applications direct to the Principal on or before the last Monday in August. Provincial candidates should apply to a superior officer of the Public Works Department not later than thirty days previous to the date fixed for the examination, and should obtain his consent to conduct the examination. Each application must be forwarded by the candidate, not direct to the Principal, but through the officer. Every application must be accompanied by a fee of ten rupees (Rs. 10), paid in cash, or currency notes, or by money-order, and the following certificates:—

(*a*) Certificate of good character, covering a period of not less than two years immediately preceding the application, from a superior under whom the candidate has served, or to whom he is well known, or by whom he has been educated.

(*b*) Certificate that the candidate is under 25 years of age (not required if candidate is in permanent Government employ or in a service which is pensionable by Government).

(*c*) Certificate that the application is in the candidate's handwriting.

These certificates may be submitted in original, or by authenticated copies, but none will be returned.

5. The Principal will decide from the certificates whether an application should be registered or rejected.

6. Examination papers for registered candidates will be sent from the College to Superintending officers in time for the examination. The following are the subjects of examination and the marks for each. In order to pass, a candidate must obtain the minimum marks in each subject, and, independently, two-thirds (400) of the total marks:—

	MAXIMUM MARKS.	MINIMUM MARKS TO PASS.
Writing (*neatness, clearness, and rapidity*) ...	100	50
Dictation (*spelling, punctuation, &c.*) ..	100	50
Arithmetic (*the whole*)	240	160
Mensuration (*the whole*)	60	30
Book-keeping (*mercantile*) .	100	50
Total	600	400

Text-books.—*Book-keeping* by Inglis (Chamber's course); *Mensuration for Beginners* by Todhunter.

7. The marks gained by candidates who fail will not be published.

8. Each examination is complete in itself. A candidate who fails at an examination and wishes to appear at a subsequent one, must furnish a fresh fee and certificates, and undergo the full examination.

9. The College of Engineering acts solely as an examining agency. Passed candidates should apply (1) to the Examiner of the Public Works Accounts, Madras, for direct appointment as Accountant, or for appointment as accounts clerk in the Examiner's Office, (2) to Superintending Engineers for appointment as accounts clerk in Executive Engineers' Offices. The passing of the examination does not give any claim to appointment; and in the selection of candidates for appointment, care will be taken that different races and castes are fairly represented.

10. After each examination, lists of successful candidates are forwarded to the Accountant-General to the Government of India, Public Works Department, to the Examiner at Madras, and to the Superintending Engineers of Circles in the Madras Presidency.

(Signed) H. D. LOVE, Major, R.E.,
Principal.

COLLEGE OF ENGINEERING,
MADRAS, 1896.

ABSTRACT OF RULES FOR THE EXAMINATIONS FOR THE DEGREE OF BACHELOR OF ENGINEERING.

The revised by-laws of the Madras University relating to these examinations come into operation as follows :—

First Examination in Engineering in the year 1894.
B.A. Degree Examination in the year 1895.

Candidates for the degree must have passed the F.A. examination of an Indian University, and subsequently attended an authorised college of engineering for not less than thirty months.

FIRST EXAMINATION IN ENGINEERING.

Applications must reach the Registrar by 1st October, and must be accompanied by—

(1) duplicate Treasury receipt for Rs. 20.
(2) F.A. certificate.

Each candidate must also despatch, so as to reach the Registrar a fortnight before the examination, a certificate from the Principal of the College that he has attended an authorised college for at least eighteen months since passing the F.A. Examination; and that he has completed the prescribed course of study.

Candidates will be examined in the following subjects :—

i. MATHEMATICS (300 *Marks*).

(*a*) **Algebra.** As in the First Arts Examination, and, in addition, permutations, binomial theorem, roots of equations, summation of series, interest.

(*b*) **Geometry.** Straight line, plane rectilineal figures, circles, ratio and proportion, similitude of figures, intersections and inclinations of planes and straight lines.

(*c*) **Mensuration.** Estimation of lengths, plane areas, curved surfaces, and volumes.

(*d*) **Plane Trigonometry.** Trigonometrical functions and formulæ. Practical use of logarithmic tables. Solution and properties of triangles.

ii. SCIENCE (300 *Marks*).

(*a*) **Dynamics.** (1) *Kinematics.* Relative and absolute motion. Parallelograms of velocities and accelerations. Uniform motion in a circle. (2) *Kinetics.* Mass and Density. Laws of Motion. Measurement of force. Equilibrium of forces at a point. Parallel forces. Couples. Mass centres. Friction. Principle of work and its application to simple machines. Equations of motion. Energy. Constrained motion. Simple pendulum. Moment of inertia. Impact.

(*b*) **Hydrodynamics.** (1) *Hydrostatics.* Fluid pressure on plane areas. Flotation. Specific gravity and its practical determination. Hydraulic press. (2) *Pneumatics.* Barometers. Siphon. Laws of Boyle and Charles. Pressure gauges. Pumps.

(*c*) **Heat.** Measurement of temperature. Behaviour of water when heated. Specific heat. Dynamical equivalent of heat. Heating value of fuels.

iii. DRAWING (300 *Marks*)

(*a*) **Geometrical Drawing.** Simple problems in practical plane geometry. Plans, elevations, and sections of simple solids. Isometric projection.

(*b*) **Building Drawing.** Masonry details ; bond, gauged and discharging arches, footings, and foundations. Timber details ; joints, roof frames, floors, doors, and windows. Iron details ; sections of cast and rolled beams, joints of iron roof frames.

(*c*) **Machine Drawing.** Riveted joints, bolts, screws, keys, pipes, and cylinders.

NOTE.—*Pencil drawings only are required during examination. The points which will receive attention are accuracy of scale and projection, ability to transfer portions of a drawing from one view to another, ability to fill in details in given sketches. Each candidate will, however, before the examination, submit finished drawings, certified to be his own unaided work, and these will be taken into account in awarding marks for the examination.*

Scheme for the First Examination in Engineering

Days	Hours	Subjects	Marks	REMARKS
Monday	10—1	Algebra and Geometry	150	Algebra 75 Geometry 75
	2—5	Mensuration and Pl Trigonometry*	150	Mensuration 50 Pl Trigonometry 100
Tuesday	10—1	Dynamics	150	
	2–5	Hydrodynamics and Heat	150	Hydromechanics 75 Heat 75
Wednesday	10—1	Geometrical Drawing .	100	
	2—5	Building Drawing	100	
Thursday	10–1	Machine Drawing	100	
		Total	900	

The examination will commence on the third Monday in January. Candidates must, in order to pass, obtain one-third of the marks in each of the three subjects, Mathematics, Science and Drawing, and one-half of the aggregate number of marks.

B.E. DEGREE EXAMINATION.

Applications must reach the Registrar by 1st October, and must be accompanied by—

(1) duplicate Treasury receipt for Rs. 30.
(2) Certificate of having passed First Examination in Engineering.

Each candidate must also forward, so as to reach the Registrar a fortnight before the examination, a certificate from the Principal of the college that he has attended an authorised college for at least twelve months since passing the First Examination in Engineering, and that he has completed the course of study prescribed.

Candidates may be examined, and may take the degree, in either the Civil branch or Mechanical branch; but they will be permitted to pass the examination in both branches, if they so desire, before proceeding to the degree.

Candidates in the Civil branch will be examined in the following subjects:—

i. MATHEMATICS (200 *Marks*).

(*a*) **Geometry.** (1) *Conic Sections.* Chief properties of the parabola, ellipse, and hyperbola. (2) *Co-ordinate Geometry.* Simple problems on the straight line, circle, parabola, and ellipse, referred to rectangular and polar co-ordinates.

(*b*) **Differential and Integral Calculus.** Differentiation of simple-functions. Theorems of Taylor and Maclaurin. Curve tracing. Maxima and minima of functions of one variable. Simple cases of integration. Rectification of curves. Areas and volumes. Moments of inertia. Mechanical integrators.

ii. CIVIL ENGINEERING (700 *Marks*).

(*a*) **Construction.** (1) *Buildings.* Selection and preparation of materials. Construction of simple buildings. Setting out. (2) *Bridges.* Construction of timber and masonry bridges, and their foundations. Setting out. Simple iron bridges for roads and railways. (3) *Roads and Railways.* Estimation of earthwork volumes. Road construction and maintenance. General principles of railway construction.

(*b*) **Hydraulic Engineering.** Flow of water through orifices, and in pipes and channels. Storage of water. Tanks and channels and their masonry works. Water-supply of towns. Town drainage.

(*c*) **Applied Mechanics and Design.** Strength of materials. Tension, compression, bending, and shearing. Bending and resisting moments. Deflection. Design of timber and iron bars and beams. Stresses in simple roof and bridge frames by graphic methods. Design of such frames. Stresses in plate and open web girders under travelling loads. Design of simple girders. Stability of arches and retaining walls.

(*d*) **Surveying.** Measurement of areas with the chain, chain and compass, and plane table. Levelling and contouring. Triangulation and traversing with the theodolite. Laying out curves. Special surveys connected with engineering design.

NOTE.—*The candidates will be practically examined in this subject in the field.*

iii. BUILDING AND TOPOGRAPHICAL DRAWING, AND ESTIMATING (300 *Marks*).

Designing and drawing building details. Drawing small buildings. Drawing minor bridges of timber, masonry, or iron. Drawing masonry works of irrigation. Preparing estimates of quantities and cost. Plotting Surveys.

NOTE.—*Pencil drawings only are required during examination. The points which will receive attention are ability to transfer portions of a drawing from one view to another, to fill in details in given sketches, to draw from notes and measurements, and to make working drawings of details. Each candidate will, however, before the examination submit finished drawings made from specification or measurement, and certified to be his own unaided work: these will be taken into account in awarding marks for the examination.*

Scheme for the Second Examination, Civil Branch.

Days.	Hours.	Subjects.	Marks.	REMARKS.
Monday	10—1 2—5	Geometry ... . Differential and Int. Calculus.	100 100	Conics 50. Co-ord. Geom 50.
Tuesday .	10—1 2—5	Construction ... ... Estimating	125 50	
Wednesday.	10—1 2—5	Construction ... ... Surveying	125 100	
Thursday ..	10—1 2—5	Building Drawing ... Building Drawing	125 125	
Friday ...	10—1 2—5	Applied Mechanics ... Hydraulic Engineering ...	150 100	
Saturday	Whole day.	Surveying Field Work ..	100	
		Total ...	1,200	

Candidates in the Mechanical Branch will be examined in the following subjects:—

i. MATHEMATICS (200 *Marks*).

As for the Civil Branch.

ii. MECHANICAL ENGINEERING (600 *Marks*).

(*a*) **Principles of Mechanism.** Conversion of motion. Application of principle of work to simple machines. Friction. Efficiency of simple machines. True surfaces and powers of measurement. Mechanical arrangements of machine tools.

(*b*) **Steam and the Steam Engine.** Generation of steam. Heating value of fuels. Boilers and their principal appendages. General description of simple forms of stationary engines. The indicator. General description of the locomotive engine and its principal details.

(*c*) **Applied Mechanics.** Strength of materials. Tension, compression, bending, shear, and torsion. Bending and resisting moments. Deflection. Strain beyond the elastic limits. Stresses in framework. Kinematics of machinery.

(*d*) **Machine Construction and Design.** Calculation of dimensions of ordinary parts of machinery, such as riveted joints, bolts, nuts, screws, keys, pipes, cylinders, shafting, couplings, bearings, belt pullies, toothed wheels, cranks, eccentrics, pistons, valves, &c. Construction of ordinary pumps, turbines, cranes, and other hydraulic machinery.

iii. MACHINE DRAWING AND ESTIMATING (400 *Marks*).

Desigining and drawing simple machine details. Drawing pieces of machinery from sketches. Making sketches from measurements. Estimates of quantities and cost of metal work.

NOTE.—*Pencil drawings only are required during the examination. The points which will receive attention are ability to transfer portions of a drawing from one view to another, to make a working drawing of a portion of a machine from a rough sketch, to make from actual measurements a sketch from which a finished drawing may be produced, to determine the forms and positions of shadows in simple cases. Each candidate will, however, before the examination submit finished drawings of machine details and machines, drawn from specifications or measurements and certified to be his own unaided work ; these will be taken into account in awarding marks for the examination.*

Scheme for the Second Examination, Mechanical Branch.

Days.	Hours.	Subjects	Marks.	REMARKS.
Monday	10—1 2—5	Geometry .. Differential and Int. Calculus.	100 100	Conics 50 Co-ord. Geom. 50.
Tuesday ...	10—1 2—5	Principles of Mechanism ... Machine Drawing ...	100 100	
Wednesday.	10—1 2—5	Machine Drawing .. ... Steam and the Steam Engine.	100 100	

Days.	Hours.	Subjects.	Marks.	Remarks.
Thursday ..	10—1 2—5	Machine Construction .. Machine Construction ...	100 100	
Friday ...	10—1 2—5	Applied Mechanics .. Applied Mechanics ...	100 100	
Saturday ...	10—1 2—5	Machine Drawing .. ... Machine Drawing	100 100	
		Total ..	1,200	

The examination will commence on the third Monday in January. Candidates must, in order to pass, obtain one-third of the marks in each of the three subjects, Mathematics, Engineering and Drawing, and one-half of the total marks.

Candidates who have passed the B.E. degree examination will not be admitted to the degree until they have produced evidence that they have spent not less than one year on engineering works, for the Civil Branch, or in engineering workshops, for the Mechanical Branch.